TRAMA TRAining in Motion Analysis

MAL Business Plan Simulation

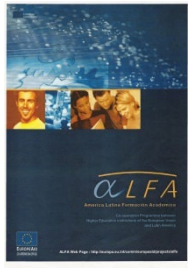
.: MANAGERIAL CONSIDERENTIONS :.

TRAMA Network Project

October 14 - 17th 2009

Carlos Alvarez M., PT
Luis Briceño A.,Bioeng.
Mariana Haro D., MD
Susana Lillo S., MD
Mónica Morante R., MD
Claudio Rozbaczylo F., PT

Instituto de Rehabilitación Infantil Teletón Chile



ALFA
EUROPEAID
CO-OPERATION OFFICE

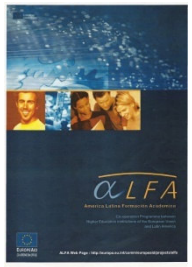
STAFF

MANAGERIAL CONSIDERENTIONS

- **2** Rehabilitation Medical Doctor
- **1** Biomedical Engineer
- **2** Physical Therapist
- **1** Informatic Engineer

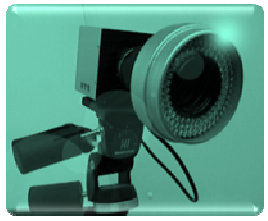
Gait & Movement Laboratory Team

Instituto de Rehabilitación Infantil Teletón Chile

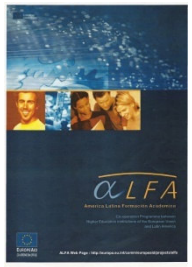


THE EQUIPMENT

MANAGERIAL CONSIDERENTIONS



- 6 Infrared cameras (100Hz)
- 1 Pocket EMG Unit (16 channels)
- 2 Force platforms
- 2 Video cameras
- Analysis software (SmartAnalyzer, Miolab)



THE USE

MANAGERIAL CONSIDERENTIONS

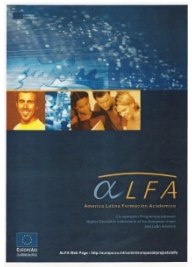
The aim use of our gait lab is for the objetive evaluation of the diferent treatment options to improve the gait. Like surgery, Botox blocks, physical therapy aproach.

Functional improvement in productivity, because it optimizes the available resources

1. Clinical Use

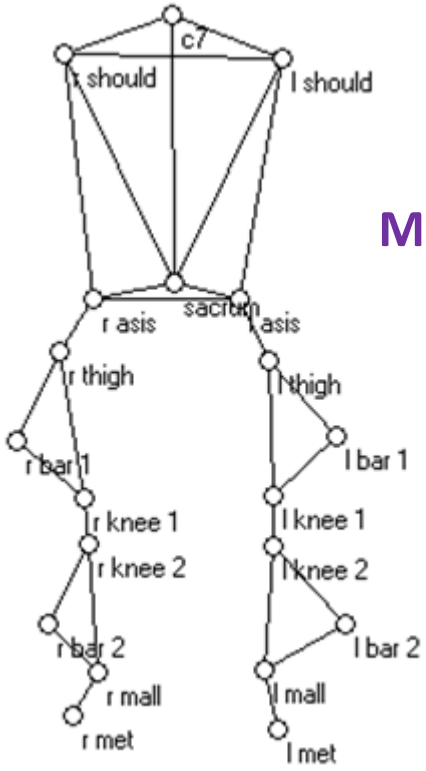
2. Investigation (TRAMA)

3. Academic use

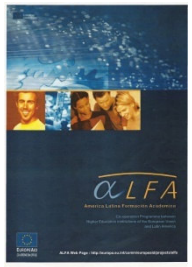


THE PROTOCOLOS

MANAGERIAL CONSIDERENTIONS



Mainy (if not only) Davis Anatomical Protocol

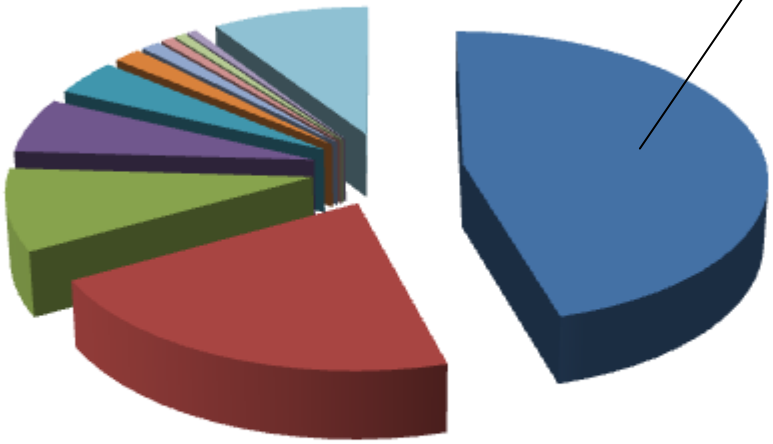


2010

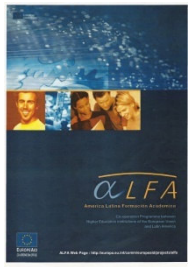
- Upper extremities protocols
- Postural studies

THE PATIENTS

MANAGERIAL CONSIDERENTIONS



The most frecuent pathology is the Cerebral palsy followed by the Spina bifida and Neuromuscular diseases



THE COSTS

MANAGERIAL CONSIDERENTIONS

INITIAN INVESTMENT

Equipment	USD 242.253
Room adecuation	USD 33.055

UPDATES

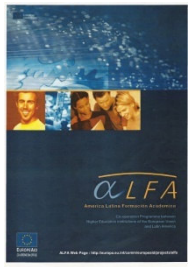
Pocket EMG	USD 21.168
Software (SmartAnalyzer)	USD 19.057

REMOTE SUPPORT

USD 35.393

SUPPLIES (Monthly)

USD 550



THE VALUES

MANAGERIAL CONSIDERENTIONS

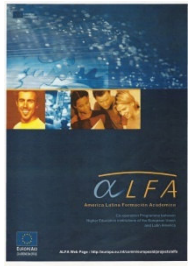
FULL EXAM

(Gait Adquisition + physical examination: report and inform)

Internal Patient	USD	???
External patient	USD	277

11 patients/week)

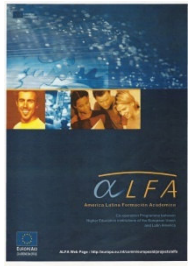
TOTAL: 2900 (2003-2009)



THE PROBLEMS

MANAGERIAL CONSIDERENTIONS

- Pocket-EMG interference (WiFi connection)
- Little time to develop new aplications
- Hard disk failure (Patient data loss)
- Data base difficult to manage
- Incompatibility of some software



MAL Business Plan Simulation

.: THESIS :.

TRAMA Network Project

October 14 - 17th 2009

Carlos Alvarez M., PT

Luis Briceño A.,Ing

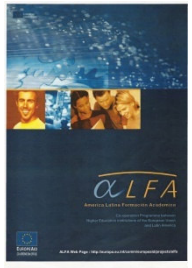
Mariana Haro D., MD

Susana Lillo S., MD

Mónica Morante R., MD

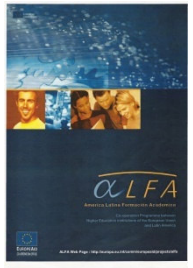
Claudio Rozbaczylo F., PT

Instituto de Rehabilitación Infantil Teletón Chile



INTRODUCTION

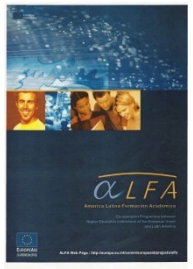
Myelomeningocelis (**MMC**) it´s a complex pathology, that involve many systems and it needs a comprehensive focus in rehabilitation.



INTRODUCTION

The incidence of MMC in Chile has decreased since the introduction of folic acid in flour (Cortes et al.) And is now 1-2 x 1000 NB Live (*).

But pathology remains **highly relevant** for the multisystem complications that produces and the high cost of their treatments

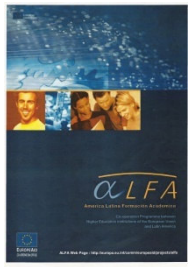


(*) Referencia *Sociedad Chilena de Medicina Física y Rehabilitación*

INTRODUCTION

Instituto de Rehabilitación Infantil Teletón Chile, annually serves **1300** children and young carriers of MMC, accounting for **6.8%** of the total patient population. *(Rotter et al, 2004)*.

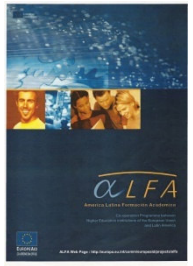
It is estimated the cost of rehabilitation care (medical checks, therapies, orthotics) in **USD 1293** *(Rotter et al)*

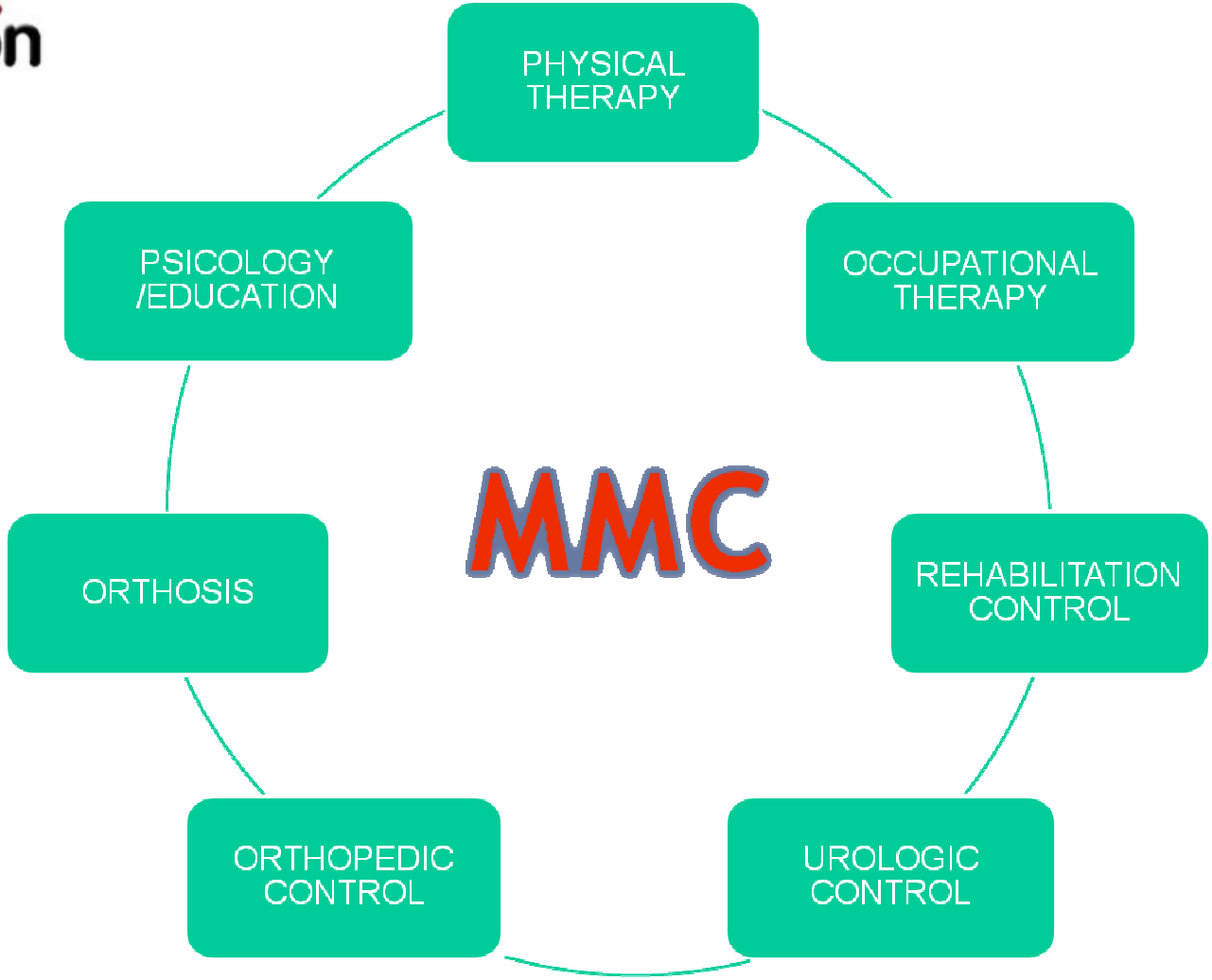


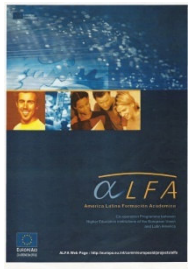
INTRODUCCIÓN

El Instituto de Rehabilitación infantil Teletón Chile, atiende anualmente a **1300** niños y jóvenes portadores de MMC, constituyendo el **6.8%** de la población total de pacientes *(Año 2004, Rotter et al)*.

Se ha estimado el costo de las atenciones de rehabilitación (controles médicos, terapias, ortesis) en **USD 1293** *(Rotter et al)*.







HIGHEST LEVELS OF INDEPENDENCE, AUTONOMY AND SOCIAL/ FAMILIAR INTEGRATION

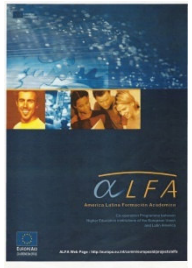
RESEARCH PROBLEM

MMC IS A DISABLING DISEASE OF CHILDHOOD THAT PRESENTS A COMPLEXITY RELATED TO MOTOR FUNCTIONAL LEVEL CATEGORIZATION

CLÍNICAL CLASIFICATIONS HAVE TRIED TO DEFINE THE FUNCTIONAL MOTOR LEVEL AND ESTABLISH PROGNOSIS OF GAIT AND MUSCLE-SKELETAL COMPLICATIONS

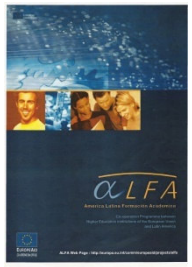
CLINICAL ASSESSMENT CAN´T FULLY CARACTERIZED THE MOTOR FUNCTIONLA LEVEL

ASIMETRY / IRREGULARITY



AIM

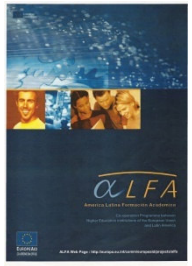
- ANALYZE KINEMATICS CHARACTERISTICS OF A GROUP OF PATIENTS WITH MMC.
- SET PARAMETERS TO QUANTIFY FUNCTIONAL MOTOR COMMITMENT
- IMPLEMENT THESE PARAMETERS IN THE FUTURE TO ALLOW ASSESSMENT OF TREATMENT RESPONSE



HYPÓTHESIS

- THERE ARE SIGNIFICANT DIFFERENCES IN THE BEHAVIOR OF KINEMATICS ACCORDING TO FUNCTIONAL COMMITMENT IN PATIENTS WITH MMC

- PARAMETERS OBTAINED FROM THE DATA KINEMATICS QUANTIFIES THE FUNCTIONAL COMMITMENT IN CHILDREN WITH FUNCTIONAL MMC



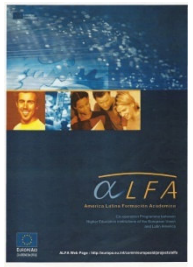
DEFINITIONS

CORRELATION FUNCTION

A method that can measure and quantify the similarity between two curves or graphical representations of functions.
Compare two sets of parameters quantitatively represented in curves of the same or different physical quantity .

The correlation functions expressed in a simple number, the percentage similarity between two curves or signals. Maximum value is 1 or 100%.

DIRECT / INDIRECT CORRELATION

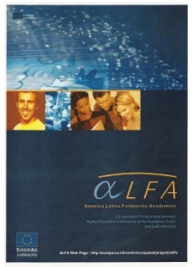


DEFINITIONS

Z - SCORE

The Z Score (or absolute value of the normal distribution) is a function that measures the dispersion of each point of a curve of a patient in standard deviations (SD)

$$Zsc = |xi - Xi| / DS$$

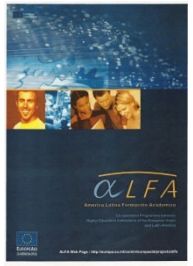


DEFINITIONS

GAIT DEVIATION INDEX (GDI)

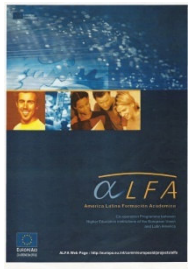
It's a new multivariate measure of overall gait pathology. The GDI uses kinematic data to derive a set of mutually independent joint patterns that efficiently describe gait. These patterns are called gait features. Linear combinations of the first 15 gait features produced a 98% faithful reconstruction of both the data from which they were derived.

The GDI and GGI are strongly correlated The GDI offers an alternative to the GGI as a comprehensive quantitative gait pathology index for other pathologies different than cerebral palsy



GENERAL PURPOSE

DEVELOP A METHODOLOGY TO EVALUATE PATIENTS WITH MMC BASED ON SOME PARAMETERS CALCULATED FROM THE KINEMATIC BEHAVIOR AND ACCORDING TO MOTOR FUNCTIONAL LEVEL.

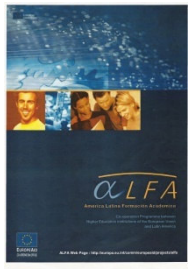


SPECIFIC OBJECTIVES

- DESCRIBE KINEMATICS CHARACTERISTICS OF PATIENTS WITH MMC ACCORDING TO THEIR MOTOR FUNCTIONAL LEVEL

- CALCULATE CORRELATION COEFFICIENTS (CC) FOR EACH KINEMATICS CURVE

- COMPARE THE CORRELATION COEFFICIENT AND Z-SCORE WITH GDI



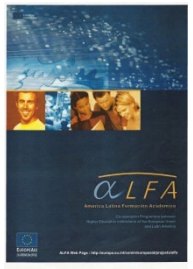
MATERIALS AND METHOD

TYPE OF STUDY:

DESCRIPTIVE

STUDY POPULATION:

PATIENTS WITH DIAGNOSIS OF MYELOMENINGOCELE (MMC)



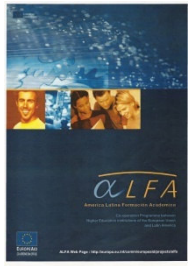
MATERIALS Y METHODS

GROUP B
Healthy
(8)

CORRELATION COEFFICIENT

ITALIAN REFERENTIAL SET

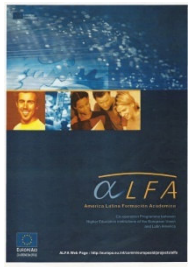
GROUP A
MMC
(19)



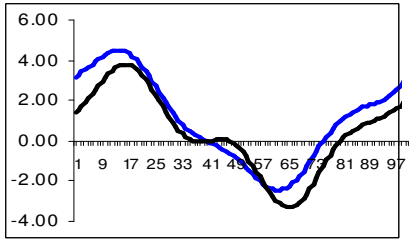
MATERIALS Y METHODS

- The subject's legal tutors of both groups were informed about the purpose of the study and evaluation procedure. They signed the informed consent according to the *Helsinki's Declaration.*

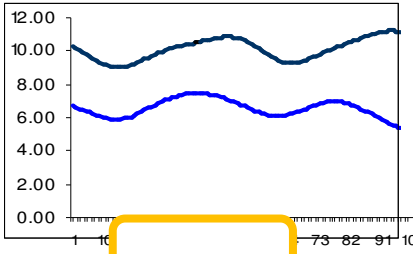
- The subjects from both groups were evaluated in the gait laboratory in barefoot condition and without tecnical aids.



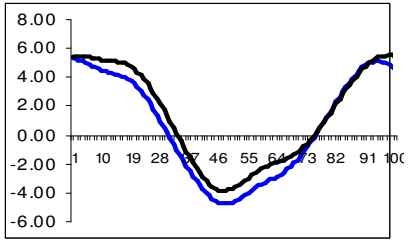
MATERIALS Y METHODS



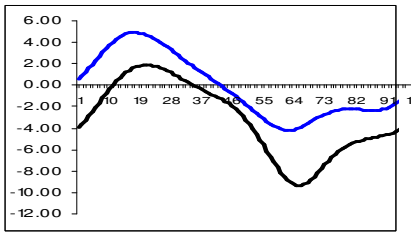
CC: 0.96



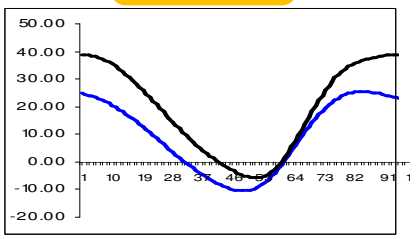
CC: 0.11



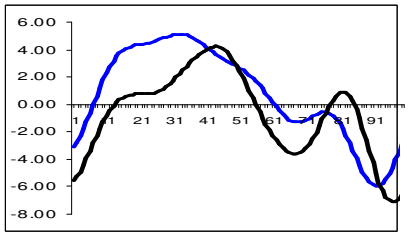
CC: 0.99



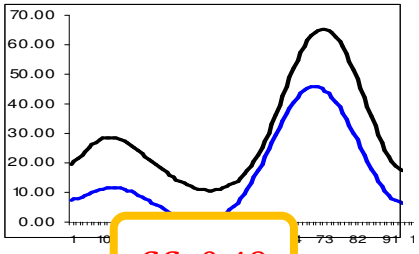
CC: 0.93



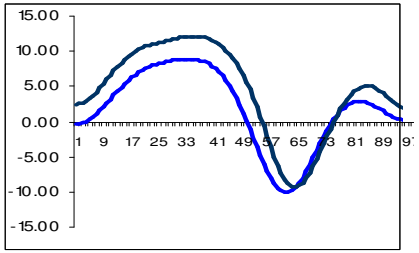
CC: 0.97



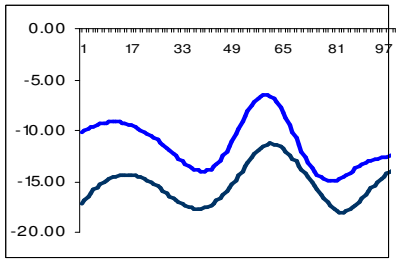
CC: 0.80



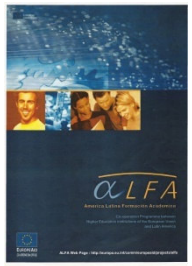
CC: 0.49



CC: 0.96



CC: 0.83



MATERIALS AND METHOD

SAMPLE:

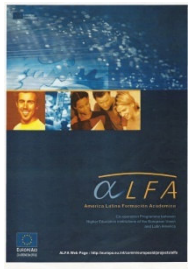
- *19 PATIENTS WITH M.M.C.*
- *RANGE OF AGE: 5 A 14 YRS (Mean 9.2 yrs. ±)*
- *MOTOR FUNCTIONAL LEVEL: L3 A S1*
- *MODE OF LOCOMOTION: INDEPENDENT COMMUNITY GAIT, BAREFOOT AND WITHOUT NEEDS FOR TECHNICAL ASSISTANCE.*

RESEARCH SITE

LABORATORIO DE MARCHA Y ANÁLISIS DE MOVIMIENTO

INSTITUTO DE REHABLITACIÓN INFANTIL TELETON

SANTIAGO - CHILE



MATERIALS AND METHOD

SELECTION PROCESS

GROUP A
PATIENTS WITH M.M.C

INFORMED CONSENT

GAIT ANALYSIS

TRIALS
7 TO 8 : 10 PATIENTS
6 : 3 PATIENTS
4 : 3 PATIENTS
3 : 3 PATIENTS

TIME / DISTANCE PARAMETERS
FRONTAL, SAGITAL, TRANSVERSE
PLANE KINEMATICS

GROUP B
NORMAL SUBJECTS

INFORMED CONSENT

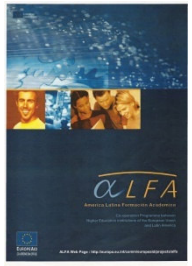
GAIT ANALYSIS

TRIALS: 7

TIME / DISTANCE PARAMETERS
FRONTAL, SAGITAL, TRANSVERSE
PLANE KINEMATICS

ITALIAN
REFERENTIAL SET

REPRESENTATIVE TRIAL



MATERIALS Y METHODS

TRIAL SELECTION (REPRESENTATIVE)

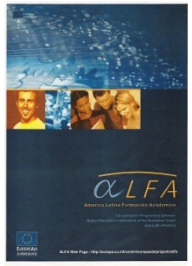
VELOCITY:
REMOVE THE FASTER AND THE SLOWER TRIALS

CONSISTENCY:
ANALYSIS / ELIMINATION

SANCE AND SWING PHASE (%)

STEP LENGTH

KINEMATIC ANALYSIS IN SAGITAL PLANE
FROM DISTAL TO PROXIMAL (Inverted pendulum)



MATERIALS AND METHOD

KINEMATICS CURVES

% GAIT CYCLE VALUES

CORRELATION COEFFICIENT

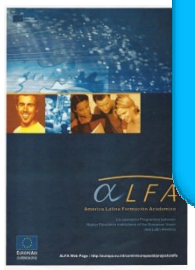
CORRELATIONS FUNCTIONS

Permite medir y cuantificar el grado de similitud entre dos curvas o representaciones gráficas de funciones.

Compara cuantitativamente dos conjuntos de parámetros representados en curvas de igual o diferente magnitud física

Las funciones de correlación expresan en un simple número, **el % de semejanza** entre dos curvas o señales. Máximo valor que es **1 ó 100 %.**

CORRELACION DIRECTA / INDIRECTA



MATERIALS AND METHOD

KINEMATICS CURVES

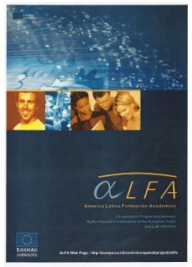
% GAIT CYCLE VALUES

Z SCORE → **1-Z SCORE**

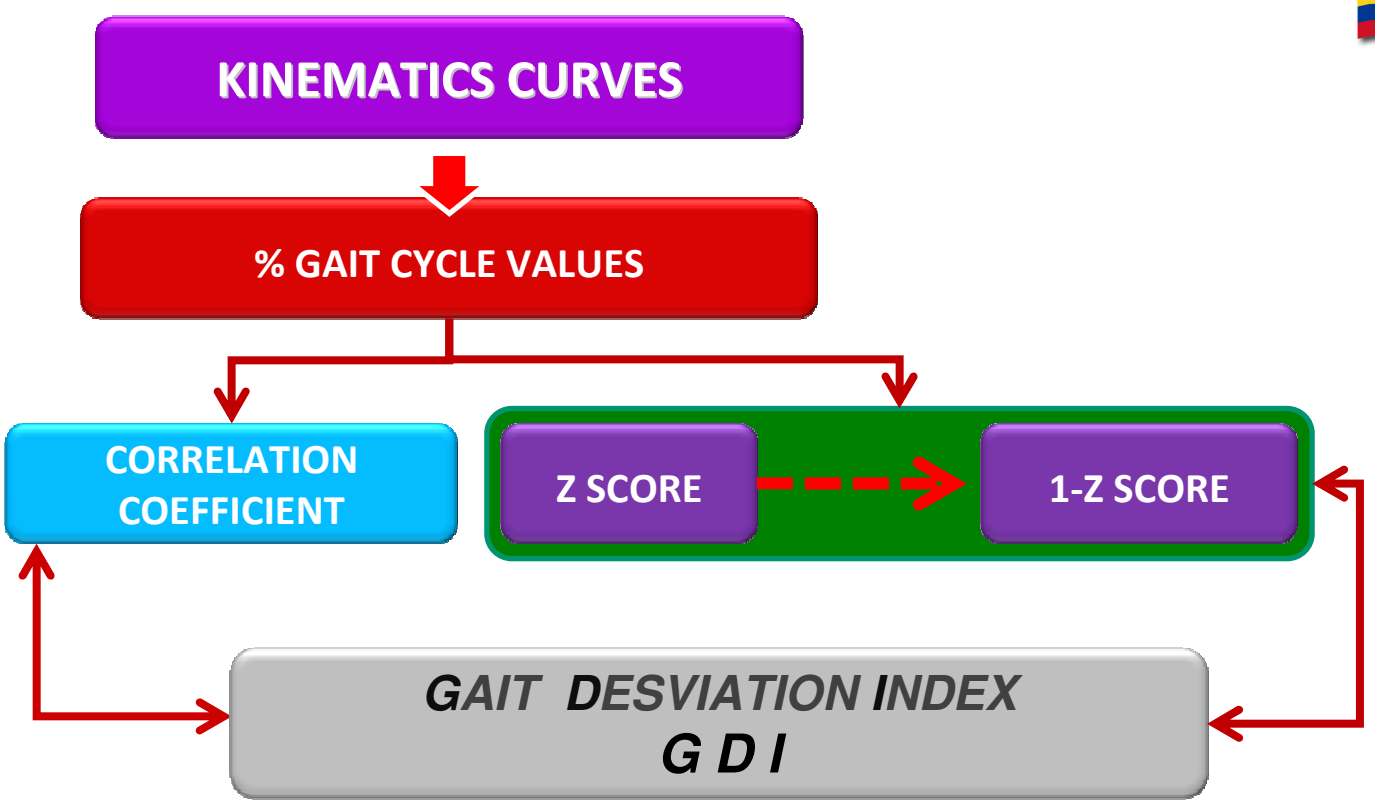
Z SCORE

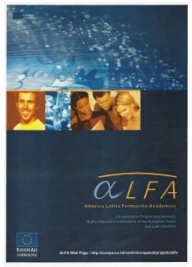
El Z Score (o valor absoluto de la distribución normal), es una función que mide la dispersión de cada punto de una curva de un paciente en Desviaciones Estándar (DS)

$Zsc = |xi - Xi| / DS$



MATERIALS AND METHOD





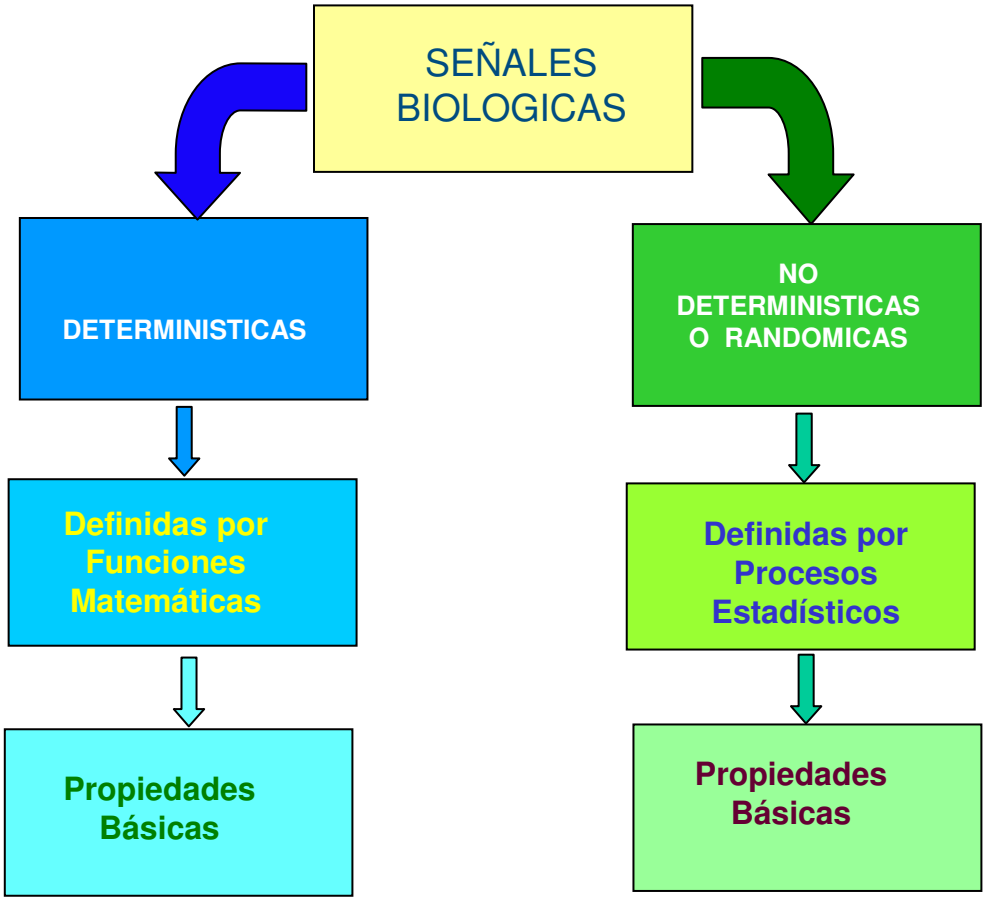
SEÑALES BIOLOGICAS

Los cambios fisiológicos de los seres vivos, ocurren en el tiempo, y el análisis de estas variaciones temporales en relación a la naturaleza y estructura, contribuyen al esclarecimiento de los procesos fisiológicos. Uno o mas parámetros que caracterizan a estos procesos y que varían en función del tiempo, se definen como “Señales Biológicas o Señales Biomédicas”.

- BIOLOGICAL SIGNALS

  The physiological changes of living organisms occur over time, and analysis of these temporal variations in relation to the nature and structure, contribute to the understanding of physiological processes.

- One or more parameters that characterize these processes, which vary with time, are defined as "biological signal or biomedical signal".


SEÑALES BIOLOGICAS
DETERMINISTICAS
NO DETERMINISTICAS O RANDOMICAS
Definidas por Funciones Matemáticas
Definidas por Procesos Estadísticos
Propiedades Básicas
Propiedades Básicas

RANDOM SIGNALS

Some basic properties of Random Signals

1) Middle Values (*)
2) Mean squared
3) Probability Density Functions
4) Function Z Score. (*)
5) Autocorrelation functions (*)
6) Functions of Power Spectral Density

Some properties of set of Random Signals

7) Probability Density Function Joint
8) Cross-Correlation Function (*)
9) Cross-spectral density function
10) Coherence function

(*) Functions used in this project.

Algunas propiedades básicas de las señales Randómicas

1) *Valores Medio (*)*
2) *Valores Cuadráticos Medio*
3) *Funciones de Densidad de Probabilidad*
4) *Función Z Score.(*)*
5) *Funciones de Autocorrelación(*)*
6) *Funciones de Densidad Espectral de Potencia*

Algunas propiedades de conjunto de señales Randómicas

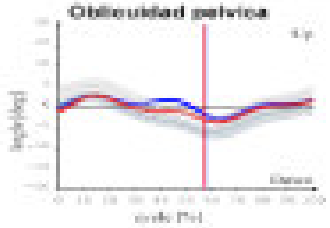
7) *Función de Densidad de Probabilidad Conjunta*
8) *Función de Correlación Cruzada(*)*
9) *Función de Densidad Espectral Cruzada*
10) *Función de Coherencia*

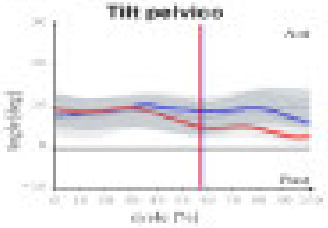
(

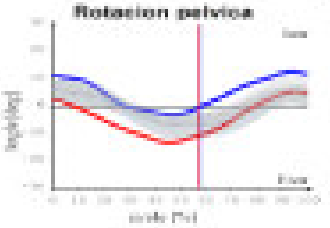
**) Funciones utilizadas en este proyecto.*

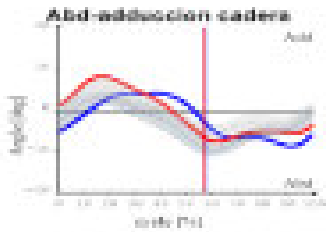
KINEMATICA

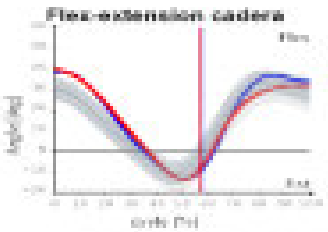
Nombre archivo 25 Nov 08

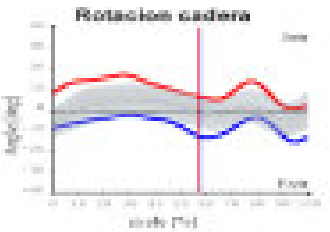






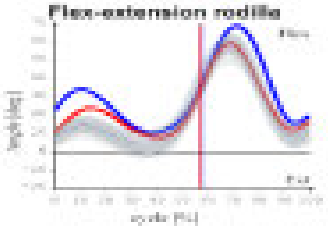


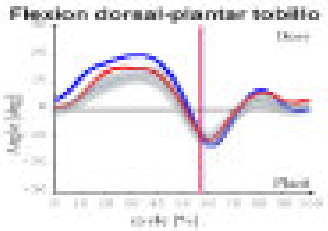


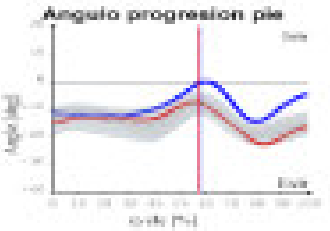


ANGULOS EN BÍPEDO

Oblicuidad pelvica	8.390	
Rotacion pelvica	4.579	
Tilt pelvico	14.200	
Abd-add cadera	-4.819	-3.211
Rot int-ext cadera	-14.015	-3.902
Flex-Ext cadera	9.801	11.197
Flex-Ext rodilla	-.785	-.312
Ang progresion pie	-13.358	-17.699
Flex Dor-Plant tobillo	0.62	9.14







Derecho

Izquierdo

norm DER

norm IZQ

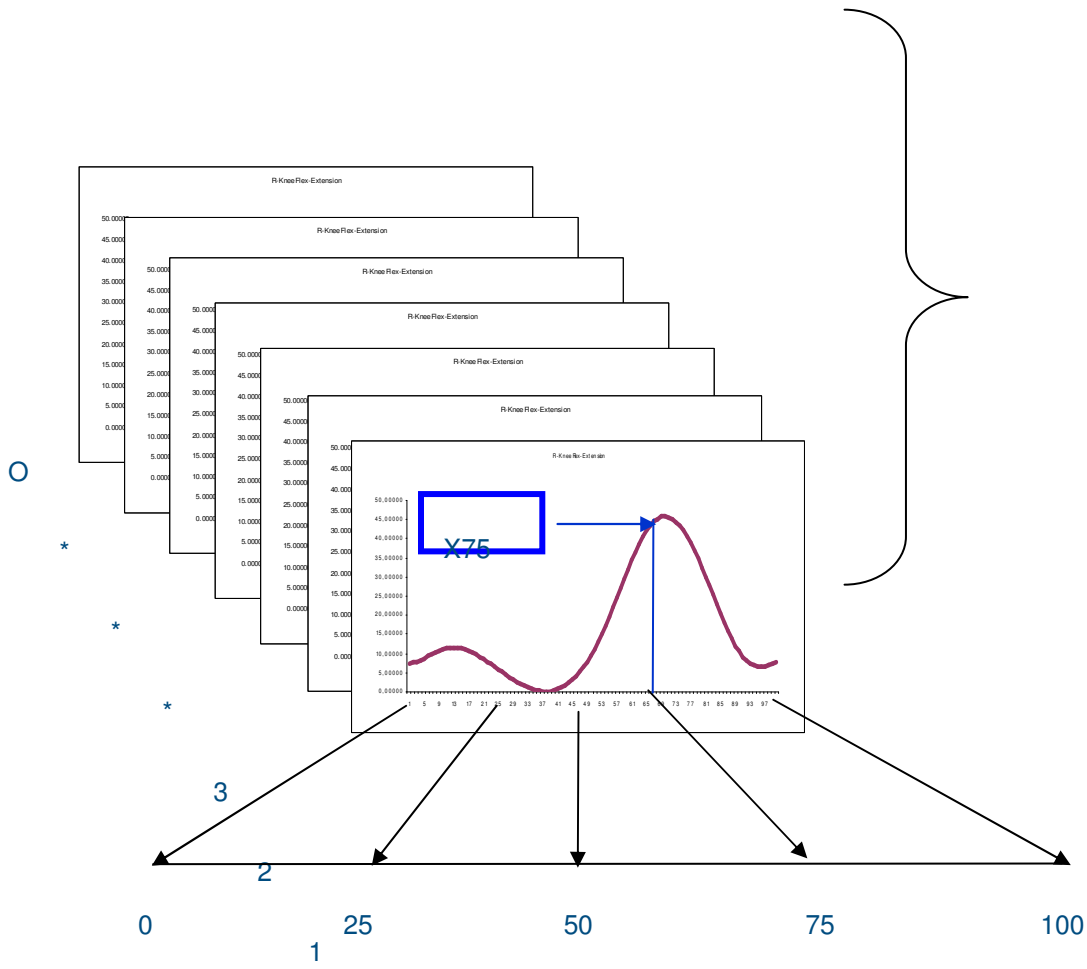
(xij)

Table of data of a patient generated by the system ELITE CLINIC

of the 9 curves Cinematic 100 points each (left and right limbs)

Samples No.	R-Pelvic Oblic	L-Pelvic Oblic	R-Pelvic Tilt	L-Pelvic Tilt	R-Pelvic Rota	L-Pelvic Rotat	R-Hip Ab-Add	L-Hip Ab-Add	R-Hip Flex-Ex	L-Hip Flex-Ex	R-Hip Rotatio	
1	1.507734	3.652888	14.2149	15.36202	7.542373	2.812343	-8.888638	3.81E-03	49.92869	46.04489	-15.95163	* * *
2	1.776552	3.788491	14.09665	15.31691	7.79533	2.815189	-8.649991	0.2230247	49.9634	46.13892	-15.54726	
3	2.050039	3.942254	13.94644	15.21933	7.988986	2.765637	-8.359727	0.4733032	49.92992	46.13018	-14.89348	* * *
4	2.330472	4.109008	13.76172	15.07159	8.125678	2.666564	-8.015841	0.7530721	49.80778	46.00904	-14.01805	
5	2.619454	4.282794	13.54115	14.87772	8.209548	2.523061	-7.619318	1.058785	49.57994	45.76781	-12.96071	* * *
6	2.917513	4.4572	13.28497	14.6434	8.246538	2.342376	-7.174019	1.385079	49.23363	45.40112	-11.77037	
7	3.223717	4.625671	12.99528	14.37572	8.244268	2.133755	-6.686437	1.724942	48.76074	44.90634	-10.5016	* * *
8	3.535396	4.781767	12.67612	14.08311	8.211775	1.908178	-6.165327	2.069898	48.15778	44.28377	-9.211098	
9	3.848077	4.914763	12.33357	13.7749	8.159117	1.6804	-5.621177	2.406893	47.42586	43.51649	-7.954358	* * *
10	4.153618	5.021883	11.97541	13.46625	8.097364	1.46652	-5.06641	2.724343	46.55669	42.63661	-6.799166	
11	4.442588	5.099913	11.61527	13.16766	8.039438	1.277873	-4.517338	3.012995	45.57189	41.65939	-5.788721	* * *
12	4.706577	5.146403	11.26493	12.88902	7.993738	1.123978	-3.986614	3.264631	44.48885	40.60107	-4.948711	
13	4.937201	5.160009	10.93569	12.63945	7.965971	1.012088	-3.485535	3.472669	43.32165	39.47981	-4.299213	* * *
14	5.126932	5.140461	10.63824	12.42701	7.958948	0.9468153	-3.0238	3.632498	42.08506	38.31489	-3.850721	
15	5.269499	5.088464	10.38208	12.25839	7.972265	0.9298741	-2.609071	3.741681	40.79382	37.12572	-3.604208	* * *
16	5.36019	5.001166	10.17484	12.14736	8.002181	0.9665332	-2.246649	3.79236	39.4618	35.93302	-3.551375	
17	5.396019	4.886278	10.02178	12.08944	8.041704	1.043263	-1.939271	3.795758	38.10109	34.75508	-3.675015	* * *
18	5.371135	4.747911	9.929741	12.08236	8.079628	1.150392	-1.691473	3.758798	36.72017	33.60098	-3.957865	
19	5.286111	4.589487	9.896619	12.12341	8.099961	1.27824	-1.50038	3.688033	35.32544	32.47592	-4.355669	* * *
20	5.147092	4.414457	9.91242	12.20821	8.089439	1.416351	-1.357918	3.590589	33.91892	31.38156	-4.816419	
21	4.956358	4.226214	9.969484	12.33099	8.035363	1.553965	-1.260185	3.473752	32.49831	30.31643	-5.299105	* * *
22	4.716557	4.028008	10.0586	12.48487	7.926565	1.680454	-1.203749	3.344604	31.05955	29.27649	-5.764357	
23	4.430722	3.822445	10.16974	12.66411	7.754089	1.780545	-1.186013	3.209818	29.59789	28.25707	-6.176543	* * *
24	4.10232	3.613842	10.29285	12.85607	7.511669	1.84565	-1.205471	3.076425	28.10905	27.24643	-6.505534	
25	3.735309	3.4049	10.41858	13.05249	7.196015	1.869633	-1.26181	2.948071	26.59041	26.23611	-6.72807	* * *
26	3.333301	3.197798	10.53841	13.24676	6.804166	1.846488	-1.357249	2.826982	25.04104	25.21861	-6.823567	
27	2.901476	2.994362	10.64452	13.43319	6.334866	1.771262	-1.496258	2.714151	23.46483	24.18691	-6.775321	* * *
*	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * *
*	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * *
*	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * * *	* * *

REFERENCE SET NORMAL CHILDREN



SET REF NORMAL

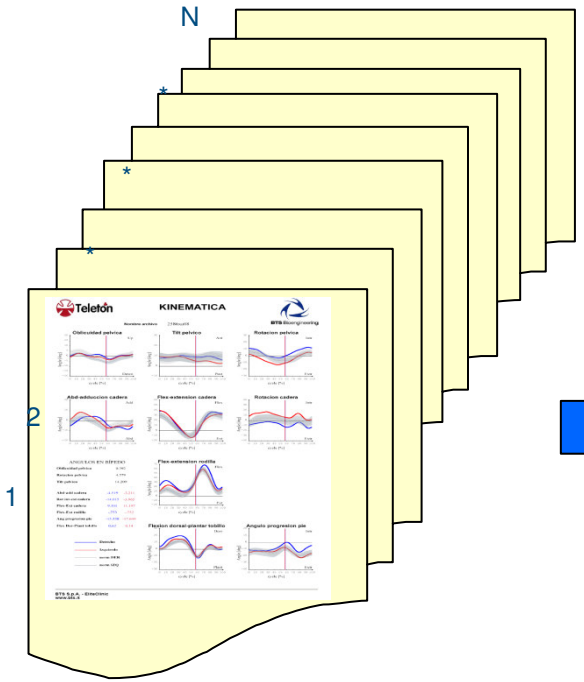
$$\bar{X}_i = 1/N \sum_{i=1}^{N} x_i \quad (j=1)$$

$i = 1,2,\ldots\ldots N$

(For each of the 100 points of the gait cycle)

SET OF DS

WALK CYCLE



SET REF NORMAL

SET OF DS

i = 1,2, ……., N (N: Nº of points for curve) N = 100 points

j = 1,2, ……., M (M: Nº of curves) M = 18 curves

(Left and Rigth legs)

k = 1,2,……., O (O: Nº of Subjects) ¿ O = 40

CORRELATION FUNCTIONS

One method that can measure and quantify the degree of similarity between two curves or graphs of functions is based on the application of correlation functions. [4], [5].

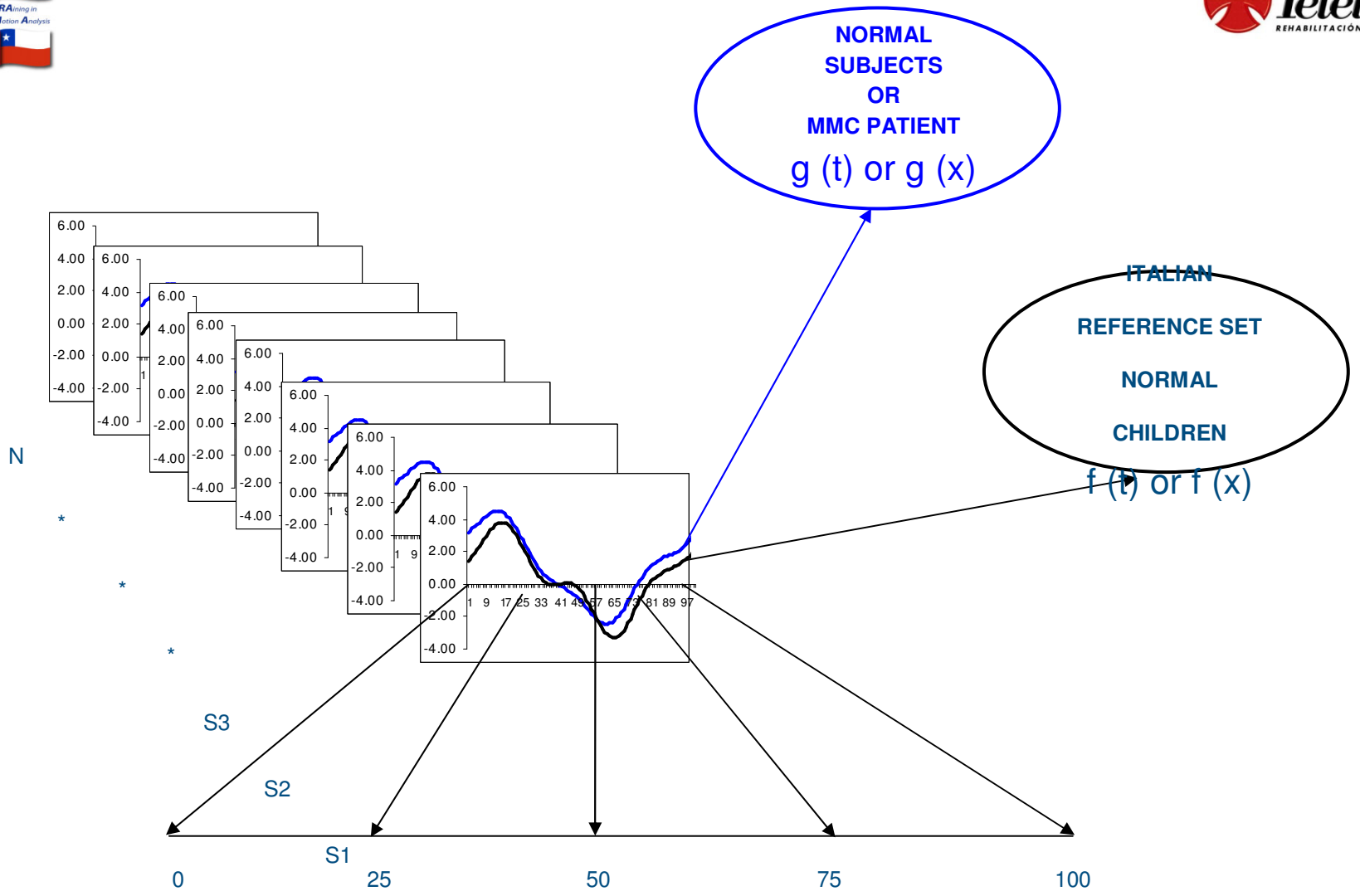
By definition: "A signal is the variation of a physical parameter with time or space" [4]; kinematics curves representing the angular variations of the lower extremity joints in terms of space or time, we can define as signals. Therefore, data obtained from the kinematic curves, can be subjected to all procedures and processes analysis in signal processing.

The correlation functions expressed in a single number the % of similarity between two curves or signals. The magnitudes of the correlations vary between "0 and 1" (direct correlation) or between "0 and -1" (in the case of inverse correlation) [6]. The correlation between a signal compared to itself gives the maximum value is "1" or 100%.

$(\overline{Xij}")$ (j"= 2j=36)

Reference Data Set of the 9 curves Cinematic 100 points each, with their respective standard deviations (left and right limbs)

Samples No.	R-Pelvic Oblic	ds	L-Pelvic Obliq	ds	R-Pelvic Tilt	ds	L-Pelvic Tilt	ds
1	3.89792	1.447308	0.3383065	1.460039	8.199476	5.125207	9.269649	4.111111
2	4.0278	1.446483	0.5512048	1.468373	8.109611	5.122598	9.163049	4.086955
3	4.169815	1.444637	0.7745886	1.477116	8.016321	5.11626	9.053683	4.059227
4	4.322753	1.442232	1.00395	1.484879	7.920331	5.10575	8.942533	4.029271
5	4.48424	1.439273	1.234041	1.49014	7.822625	5.090751	8.831018	3.998225
6	4.651253	1.435041	1.459097	1.491466	7.724665	5.070883	8.720904	3.96707
7	4.819685	1.429374	1.673068	1.487747	7.628629	5.045678	8.61427	3.936627
8	4.982712	1.424342	1.869285	1.478051	7.53632	5.01581	8.513353	3.90757
9	5.133708	1.421723	2.042462	1.461928	7.450606	4.981854	8.420959	3.880666
10	5.266747	1.423875	2.187564	1.44029	7.374163	4.945361	8.339617	3.856479
11	5.376106	1.433559	2.299303	1.414777	7.310469	4.906831	8.271946	3.834878
12	5.456186	1.453614	2.37424	1.387831	7.262319	4.867692	8.219843	3.816403
13	5.503059	1.485357	2.409092	1.362546	7.232089	4.829532	8.1848	3.801069
14	5.512775	1.529322	2.400565	1.341115	7.222624	4.793362	8.167841	3.788769
15	5.482438	1.585183	2.34773	1.326696	7.236017	4.758637	8.168865	3.779042
16	5.409212	1.64968	2.250801	1.321896	7.273367	4.725624	8.186858	3.771051
17	5.296165	1.718689	2.110783	1.326876	7.333136	4.6946	8.219969	3.763781
18	5.14551	1.788324	1.930003	1.339823	7.41373	4.665228	8.265636	3.756075
19	4.95972	1.854763	1.711727	1.356944	7.51271	4.63702	8.320803	3.746827
20	4.740954	1.914448	1.460028	1.37273	7.62705	4.609519	8.382415	3.734808
21	4.491168	1.962993	1.18223	1.383679	7.753094	4.581997	8.446846	3.720418
22	4.217454	1.999484	0.8855281	1.387034	7.886428	4.554233	8.511113	3.703927
23	3.924793	2.022977	0.5766352	1.381057	8.022591	4.526431	8.573073	3.68636
24	3.618198	2.033214	0.2620391	1.365823	8.158142	4.498378	8.63133	3.669354
25	3.301738	2.030568	-5.25E-02	1.343094	8.29009	4.470143	8.685339	3.654808
26	2.980331	2.017351	-0.3613079	1.316093	8.41587	4.442141	8.734835	3.644615
27	2.659733	1.996814	-0.6597168	1.288457	8.533988	4.414681	8.779656	3.640538
28	2.344517	1.971685	-0.9436511	1.263625	8.642955	4.388945	8.81972	3.643941
29	2.038952	1.944512	-1.209787	1.244494	8.742002	4.366051	8.854218	3.656913
30	1.747708	1.916853	-1.456474	1.232306	8.830374	4.347494	8.882937	3.678824
31	1.474216	1.890189	-1.682384	1.228061	8.908144	4.334197	8.905178	3.709297
32	1.220803	1.86465	-1.887611	1.23175	8.975389	4.326752	8.919609	3.747693
33	0.9904435	1.838225	-2.072367	1.243088	9.032109	4.325857	8.925028	3.792829
34	0.7829199	1.811147	-2.238565	1.261071	9.077695	4.331808	8.920478	3.843128
35	0.5990906	1.783785	-2.388303	1.284332	9.109381	4.347532	8.905064	3.896734


NORMAL
SUBJECTS
OR
MMC PATIENT
g (t) or g (x)
ITALIAN
REFERENCE SET
NORMAL
CHILDREN
f (t) or f (x)
N
S3
S2
S1
0
25
50
75
100

WALK CYCLE

R-Knee Flex-Ext

f (x) ITALIAN REF SET NORMAL CHILDREN

CHILEAN GROUP OF NORMAL SUBJECTS

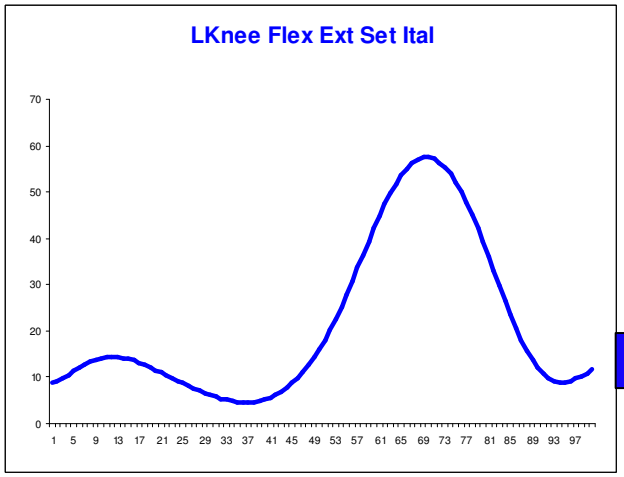
g (x)

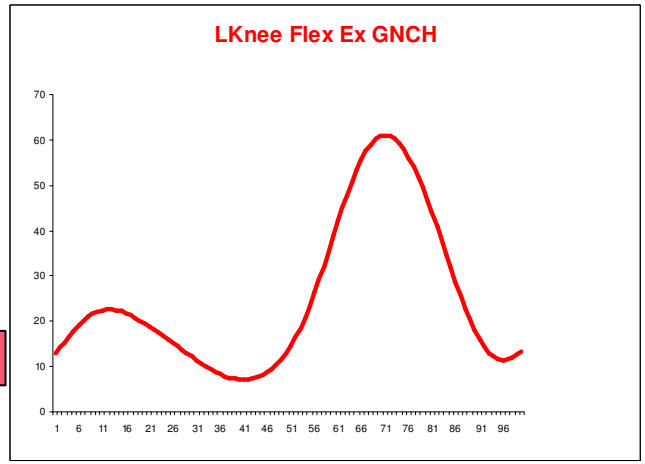
L-Knee Flex-E

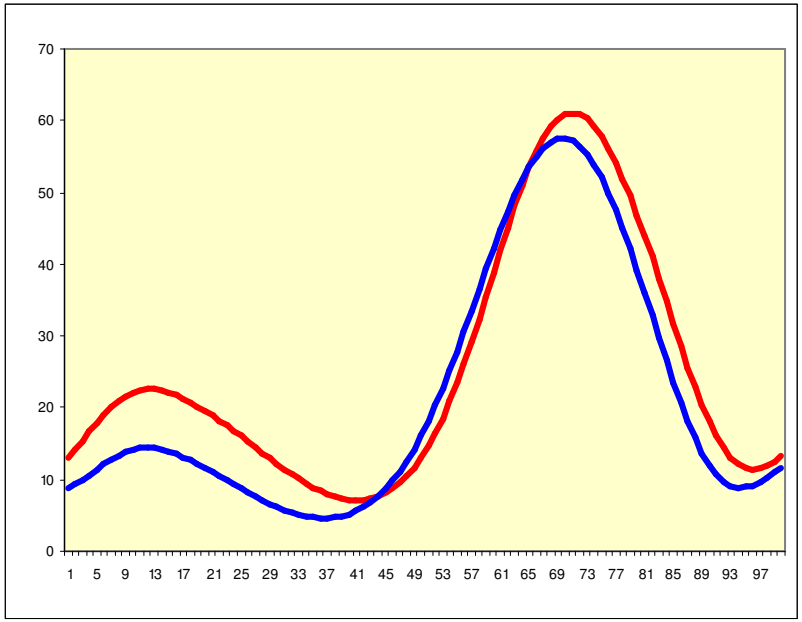
7.56892
7.67477
7.93629
8.31901
8.78719
9.30542
9.83641
10.34320
10.79205
11.16243
11.43481
11.59800
11.64956
11.58586
11.40836
11.12100
10.74355
10.28877
9.76818
9.19172
8.56896
7.91625
7.24361
6.55996
5.87227
5.18864
4.51840
3.86813
3.24436
2.65501
2.10744
1.60811
1.16692
0.78788
0.48571
0.26196
0.12610

* * * * *

* * * * *







CC = 0,97

13.43
14.59
15.85
17.14
18.42
19.62
20.68
21.59
22.32
22.86
23.20
23.35
23.34
23.18
22.89
22.49
22.00
21.44
20.83
20.17
19.49
18.78
18.05
17.30
16.54
15.76
14.96
14.16
13.37
12.58
11.82
11.08
10.39
9.75
9.16
8.62
8.17

* * *

* * *

Z SCORE FUNCTION

The Z Score (or absolute value of the normal distribution) is a function that quantifies the dispersion of each point on a curve and express this dispersion “std." [7].

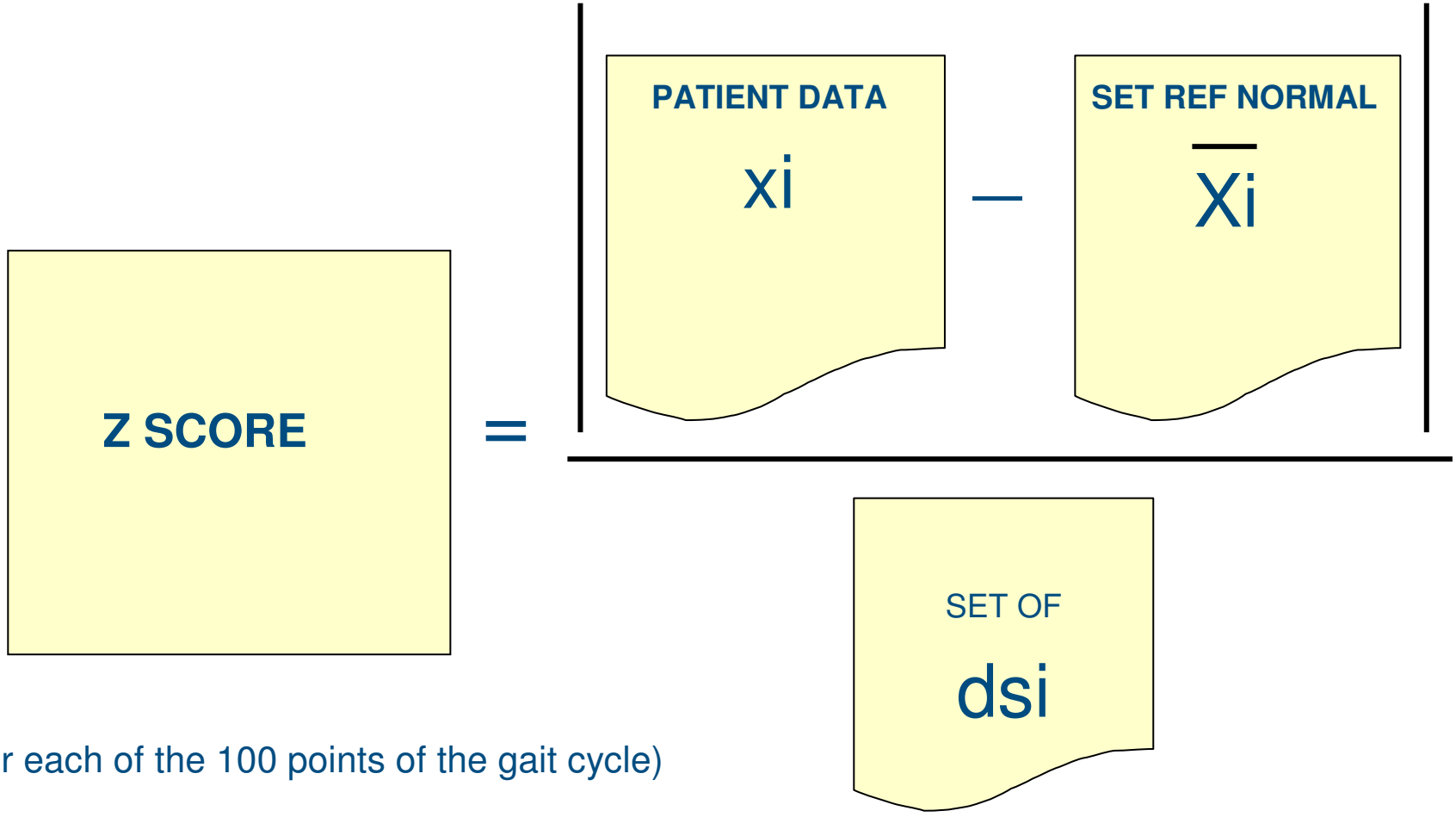
Mathematically, the Zsc is the absolute value of the difference between the values or data from the normal subject or patient, the less the normal mean value, divided by the corresponding standard deviation.

$$Zsc = \left| xi - \bar{X}i \right| / stdi$$

xi (i =1,2,……,100): angular values of each of the 9 curves kinematic

$\bar{X}i$: Average value of normal angles of each point (Normal reference set)

stdi : Standard deviation



(For each of the 100 points of the gait cycle)

SUPPLEMENT Z SCORE

There is an inverse relationship between correlations and Zsc; If the correlation is maximum, 100%, means that there are scattered points of the signal under study, and therefore in Zsc is zero.

However, If you want to establish a direct relationship between the correlations and Zsc is desirable in connection with a function that has been defined as the Zsc Supplement:

- ***Supp Zsc = 1 – Zsc***

If Zsc is greater than 1, then 1-Zs is negative (Zsc > 1 => 1-Zsc < 0)

Supp k Zsc = 1 – (Zsc/k)

for k = 1,2, ……,10

The constant k allows *Supp Zsc* is always positive.

PRELIMINARY RESULTS OF THE SYSTEM

CORRELATION COEFFICIENTS, Z SCORE, SUPPLEMENT ZSC AND COMPARATION WITH GDI

ITALIAN REFERENCE SET NORMAL CHILDREN

CHILEAN GROUP OF NORMAL SUBJECTS

GATE DESVIATION INDEX (GDI)

The GDI is a new multivariate measure of overall gait patology. This index use kinematic data from a large number of walking strides to derive a set of mutually independent joint rotation patterns that efficiently describe gait[2],[3].

GDI $\geq$100 indicates the absence of gait pathology.

Every 10 points that the GDI falls below 100 corresponds 1 ds.

KINEMATIC DATA OF THE SUBJECT UNDER STUDY RIGHT LEG

			Nº PACIENTE
Datos	SELECCIÓN	RENUM	1792XA06
Suma de R-Pelvic Tilt	IMP	0	4.443601
		1	4.271838
		3	3.946247
		5	3.653952
		7	3.410297
		9	3.235209
		11	3.14927
		13	3.168588
		15	3.299307
		17	3.533452
		19	3.848752
		21	4.213951
		23	4.597749
		25	4.976884
		27	5.338773
		29	5.678142
		31	5.991841
		33	6.277381
		35	6.537979
		37	6.791026
		39	7.067232
		41	7.399741
		43	7.805759
		45	8.271266
		47	8.748138
		49	9.167585
		51	9.465003
		53	9.60575
		55	9.597893
		57	9.48465
		59	9.321388
		61	9.150683
		63	8.988444
		65	8.824998
		67	8.637609
		69	8.407956
		71	8.136813
		73	7.847152
		75	7.577782
		77	7.369171
		79	7.247737
		81	7.215105
		83	7.246412
		85	7.298067
		87	7.321984
		89	7.281378
		91	7.162225
		93	6.975821
		95	6.750869
		97	6.518631
		99	6.298814
Suma de R-Pelvic Obliquity	IMP	0	1.412389

Suma de R-Foot Progression	IMP	0	-13.75314
		1	-13.57089
		3	-13.26107
		5	-13.01307
		7	-12.80385
		9	-12.60544
		11	-12.4055
		13	-12.22468
		15	-12.11627
		17	-12.14859
		19	-12.38098
		21	-12.84404
		23	-13.53096
		25	-14.40195
		27	-15.39838
		29	-16.45605
		31	-17.50599
		33	-18.46272
		35	-19.20931
		37	-19.62166
		39	-19.59855
		41	-19.10352
		43	-18.18281
		45	-16.94949
		47	-15.54393
		49	-14.09431
		51	-12.6983
		53	-11.43026
		55	-10.35857
		57	-9.550179
		59	-9.053576
		61	-8.876945
		63	-8.986466
		65	-9.329982
		67	-9.870537
		69	-10.60037
		71	-11.52584
		73	-12.62984
		75	-13.83404
		77	-14.99284
		79	-15.92292
		81	-16.45505
		83	-16.49398
		85	-16.06848
		87	-15.33494
		89	-14.5071
		91	-13.75014
		93	-13.1194
		95	-12.57826
		97	-12.06285
		99	-11.54121

EXCEL SHEET FOR CALCULATING THE GDI

Kinematic data of the subject under study

Gait Data: arrange the 459 datum describing the kinematics

Seg/Jnt Rotation	% Gait Cycle	g
Pelvis Ant/Pst	*0,00*	20,9
Pelvis Ant/Pst	*0,02*	21,5
Pelvis Ant/Pst	*0,04*	21,8
Pelvis Ant/Pst	*0,06*	21,7
Pelvis Ant/Pst	*0,08*	21,3
Pelvis Ant/Pst	*0,10*	20,9
Pelvis Ant/Pst	*0,12*	20,7
Pelvis Ant/Pst	*0,14*	20,5
Pelvis Ant/Pst	*0,16*	20,6
Pelvis Ant/Pst	*0,18*	20,7
Pelvis Ant/Pst	*0,20*	20,9
Pelvis Ant/Pst	*0,22*	21,1
Pelvis Ant/Pst	*0,24*	21,3
Pelvis Ant/Pst	*0,26*	21,4
Pelvis Ant/Pst	*0,28*	21,5
Pelvis Ant/Pst	*0,30*	21,5
Pelvis Ant/Pst	*0,32*	21,5
Pelvis Ant/Pst	*0,34*	21,5
Pelvis Ant/Pst	*0,36*	21,4
Pelvis Ant/Pst	*0,38*	21,4
Pelvis Ant/Pst	*0,40*	21,4
Pelvis Ant/Pst	*0,42*	21,5
Pelvis Ant/Pst	*0,44*	21,7

c: the subject projections

component	subject	control	diff
c1	-267,95	-279,61	11,67
c2	2,43	30,73	-28,30
c3	-43,43	-56,45	13,03
c4	-157,57	-30,86	-126,70
c5	54,74	3,51	51,23
c6	-20,71	47,42	-68,14
c7	-97,08	53,22	-150,30
c8	-44,55	32,67	-77,22
c9	-38,67	6,75	-45,41
c10	51,69	-5,76	57,45
c11	-1,17	14,68	-15,85
c12	5,04	6,80	-1,76
c13	-31,41	11,69	-43,10
c14	1,35	11,95	-10,60
c15	15,26	-18,58	33,84

ln(d): the natural log of the Euclidean distance between subject and control

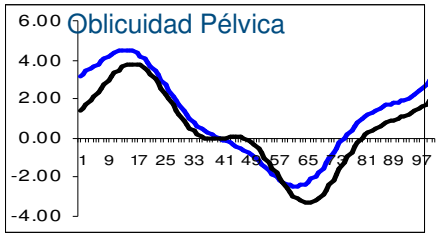
ln(d)
5,52

z: z-score for subject ln(d)

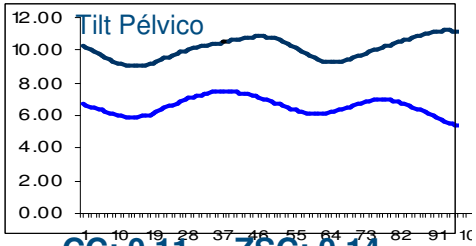
z(ln(d))
2,76

GDI
72,42

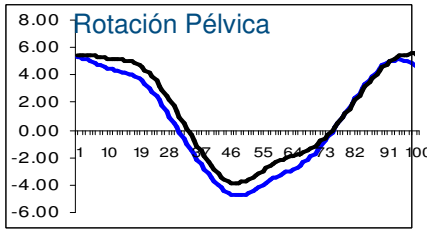
KINEMATICA R



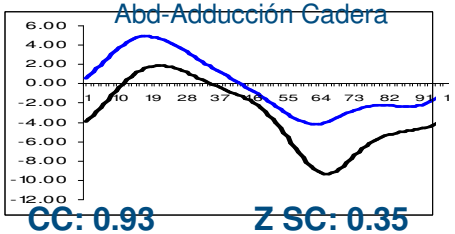
CC: 0.96 ZSC: 0,12



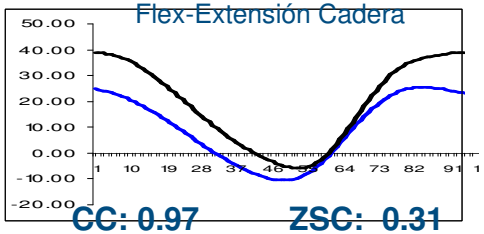
CC: 0.11 ZSC: 0.14



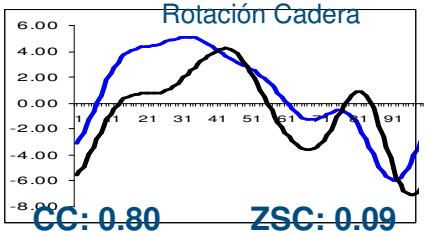
CC: 0.99 ZSC: 0.06



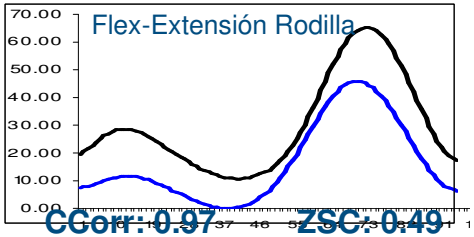
CC: 0.93 Z SC: 0.35



CC: 0.97 ZSC: 0.31



CC: 0.80 ZSC: 0.09



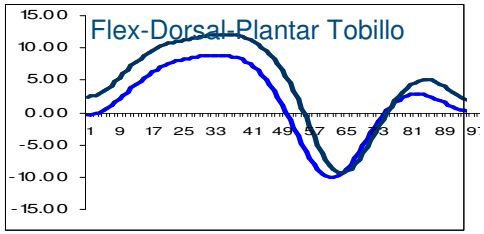
CCorr: 0.97 ZSC: 0.49

SET REF ITAL R

Ln(D)= 4,48

Z(Ln(D))= -0,72

GDI= 107,17



CC: 0.96 ZSC: 0.25

R Prom Corr = 0.84

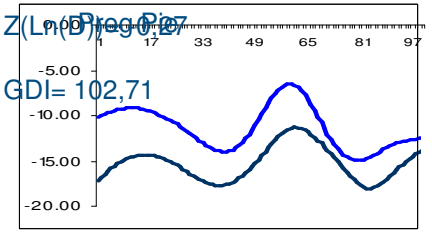
Prom ZsN R Tot = 0.23

GRUP CONT CHILENO R

Ln(D)= 4,61

Z(Ln(D))= 0,12

GDI= 102,71



CC: 0.83 ZSC: 0.27

COEFICIENT OF CORRELATION RIGTH

Pelvic Obliquity 0.96

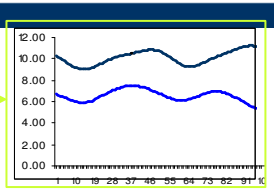
Pelvic Tilt 0.11

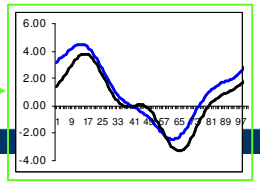
Pelvic Rotation 0.99

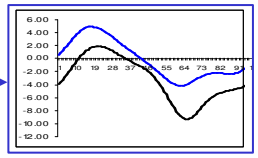
Hip Ab/Adduc 0.93

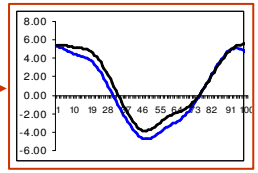
Hip Flex/Ext 0.97

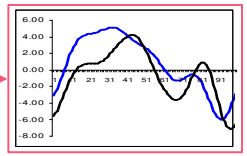
Hip Rotation 0.80

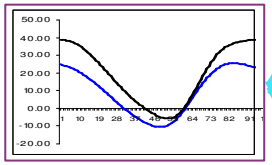


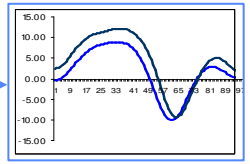


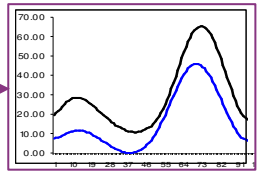


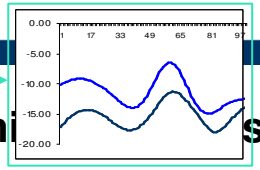


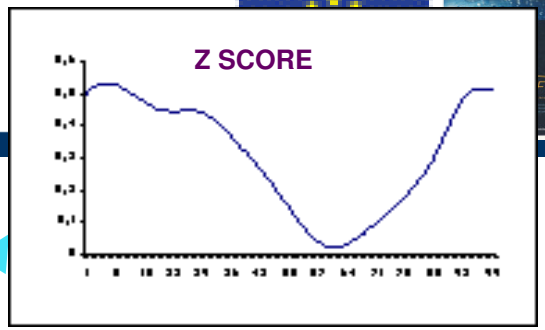


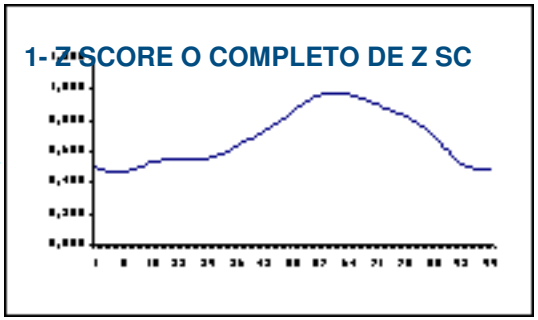


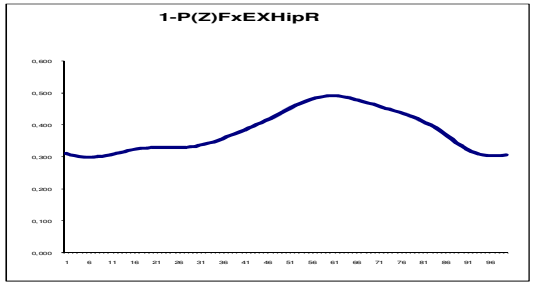


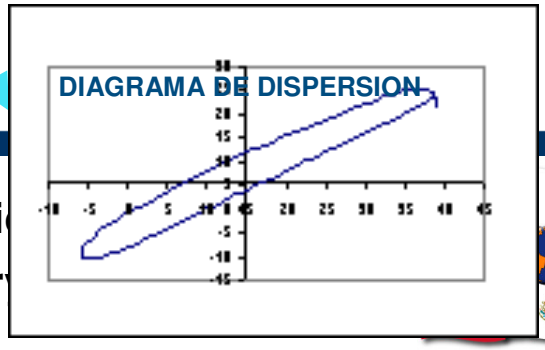








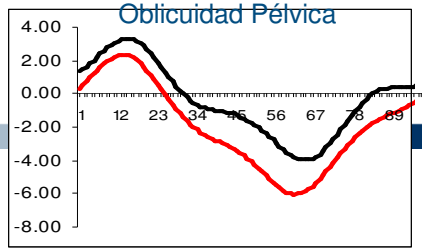




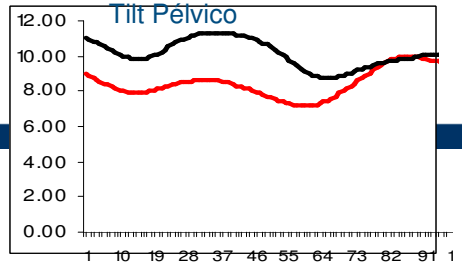
Course “Motion Analysis and clini set up a Moti

- Clinical cases presentation - TRAMA Project – Januar

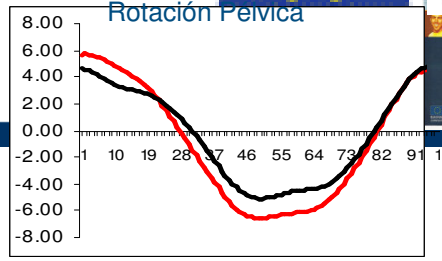
KINEMATICA L



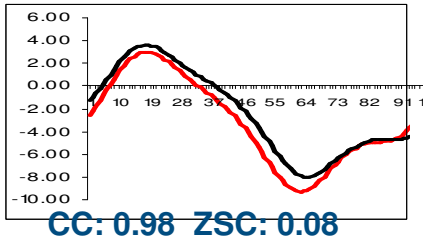
CC: 0.99 ZSC: 0.19



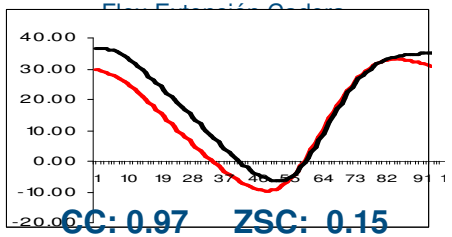
CC: 0.15 ZSC: 0.08



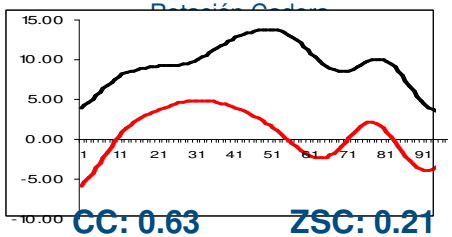
CC: 0.99 ZSC: 0,05



CC: 0.98 ZSC: 0.08



CC: 0.97 ZSC: 0.15



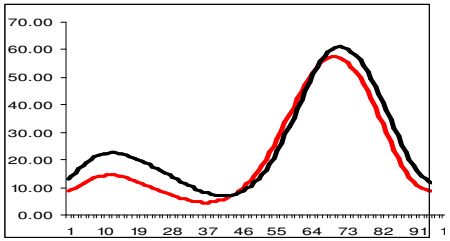
CC: 0.63 ZSC: 0.21

SET REF ITAL L

Ln(D)= 4,54

Z(Ln(D))= -0,51

GDI= 105,11



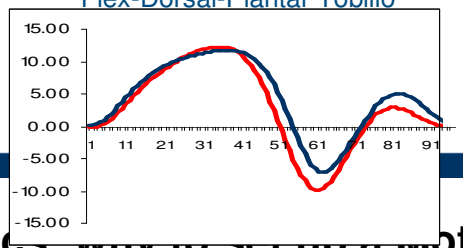
CC: 0.97 ZSC: 0.16

R Prom Corr = 0.85

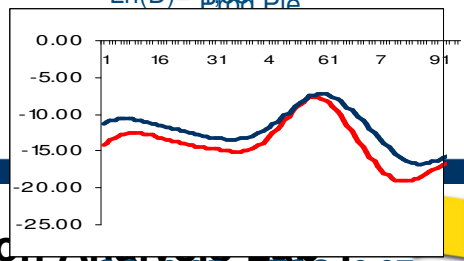
Prom ZsN R Tot = 0.12

GRUP CONT CHILENO L

Ln(D)= 4,53



CC: 0.98 ZSC: 0.09



CC: 0.95 ZSC: 0.07

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

***- Clinical cases presentation -* TRAMA Project – January 14 – 17th 2008**

COEFICIENT OF CORRELATION LEFT

Pelvic Obliquity 0.99

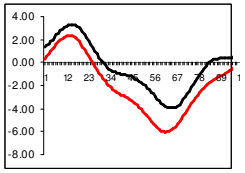
Pelvic Tilt 0.15

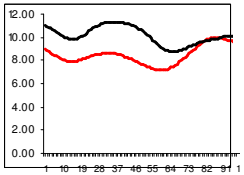
Pelvic Rotation 0.99

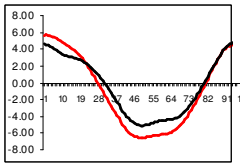
Hip Ab/Adduc 0.98

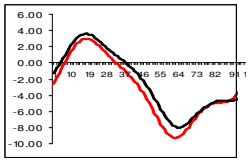
Hip Flex/Ext 0.97

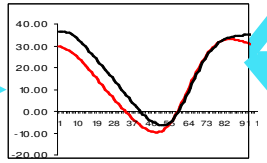
Hip Rotation 0.63

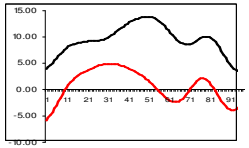


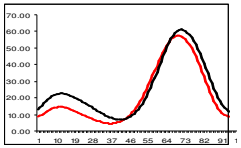


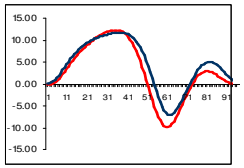


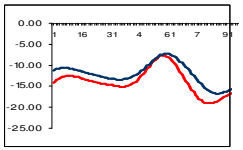


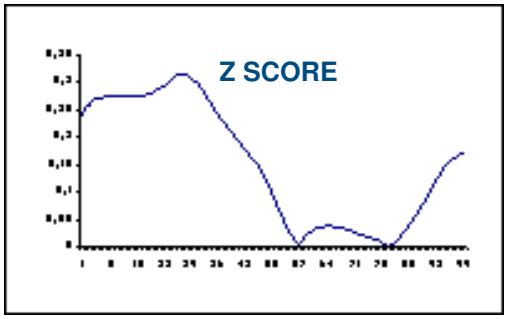


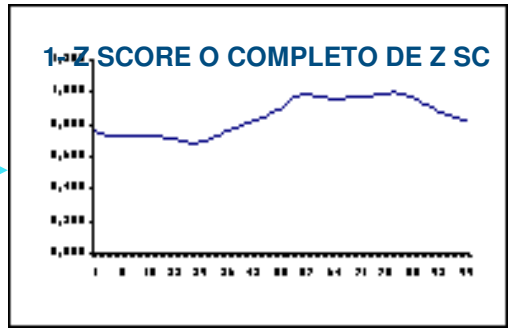


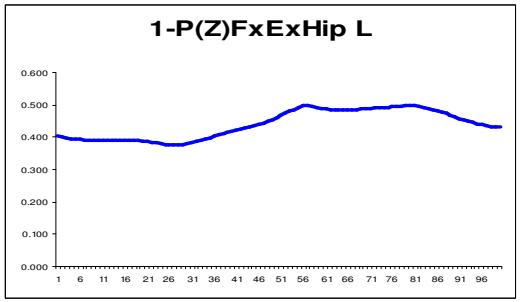










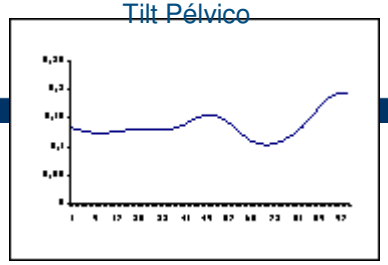


Z SCORE R

Oblicuidad Pélvica

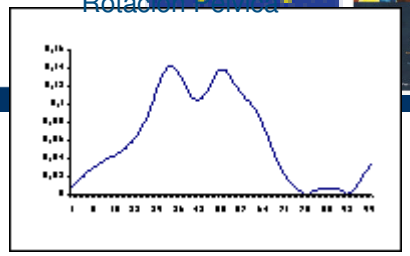
Z sc = 0,124

Tilt Pélvico



Zsc = 0,137

Rotación Pelvica

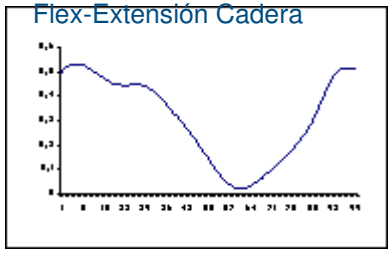


Zsc = 0,062

Abd-Adducción Cadera

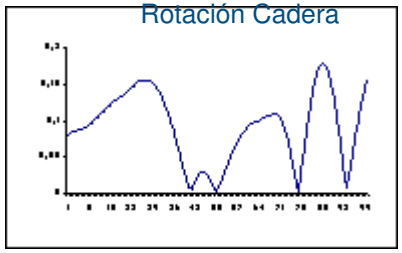
Zsc = 0,346

Flex-Extensión Cadera



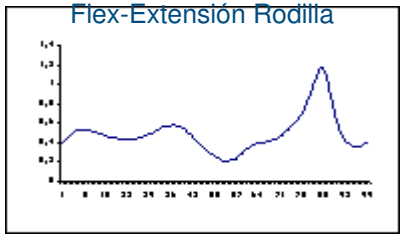
Zsc = 0,311

Rotación Cadera



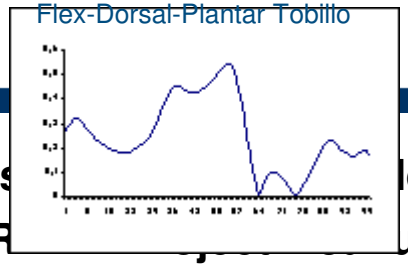
Zsc = 0,09

Flex-Extensión Rodilla



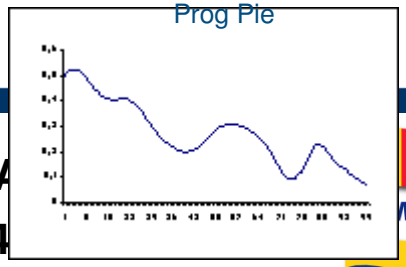
Zsc = 0,493

Flex-Dorsal-Plantar Tobillo



Zsc = 0,252

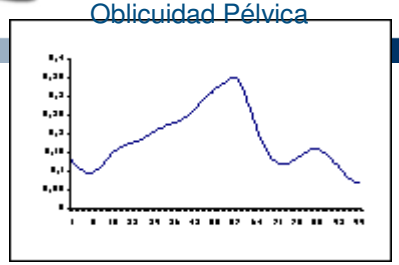
Prog Pie



Zsc = 0,269

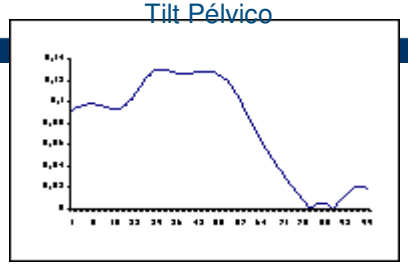
Z SCORE L

Oblicuidad Pélvica



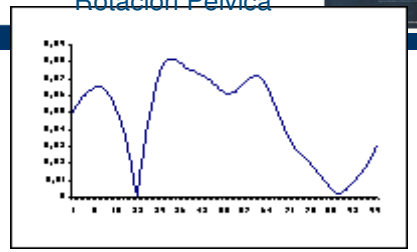
Zsc =0,186

Tilt Pélvico



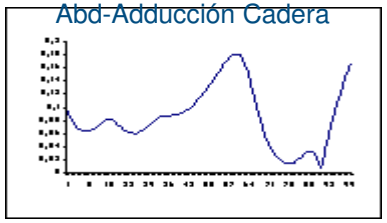
Zsc = 0,077

Rotación Pelvica



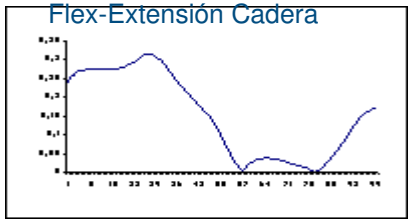
Zsc = 0,047

Abd-Adducción Cadera



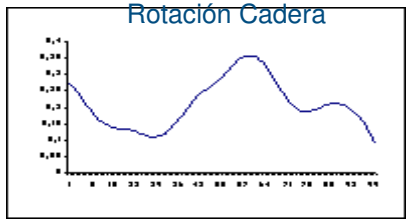
Zsc = 0,085

Flex-Extensión Cadera



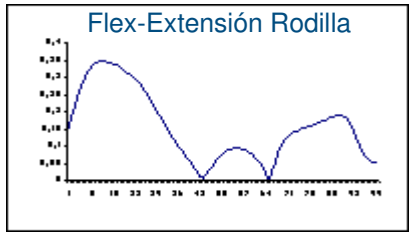
Zsc = 0,152

Rotación Cadera



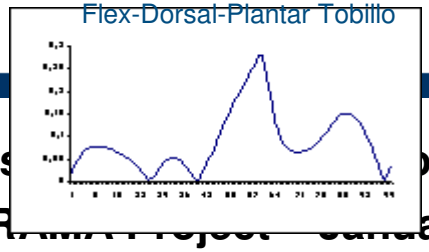
Zsc = 0,209

Flex-Extensión Rodilla



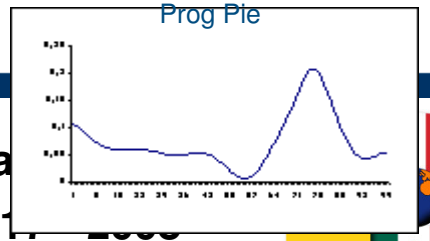
Zsc = 0,156

Flex-Dorsal-Plantar Tobillo



Zsc = 0,090

Prog Pie



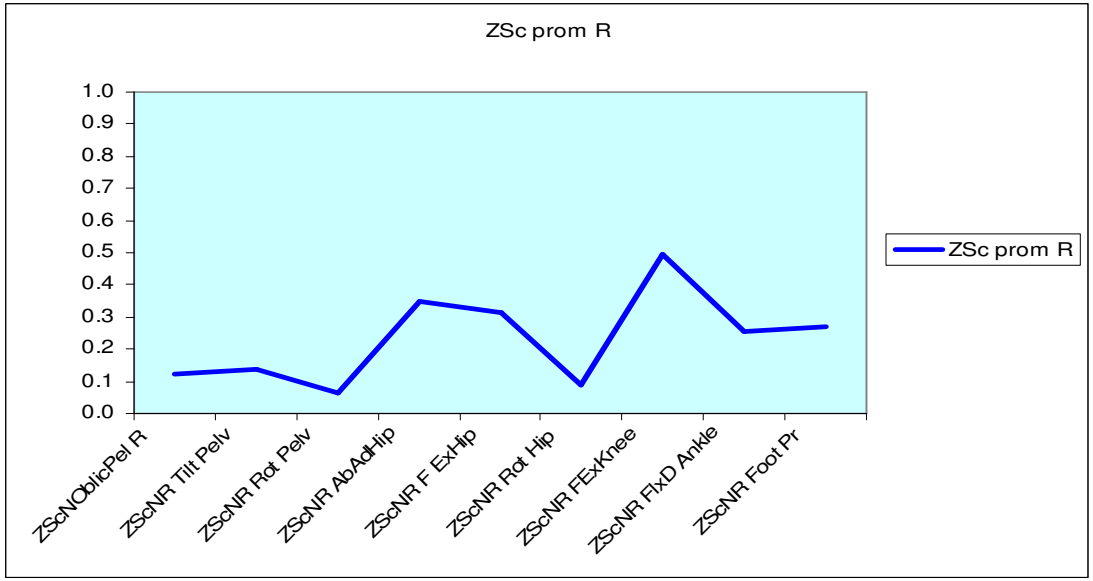
Zsc = 0,073

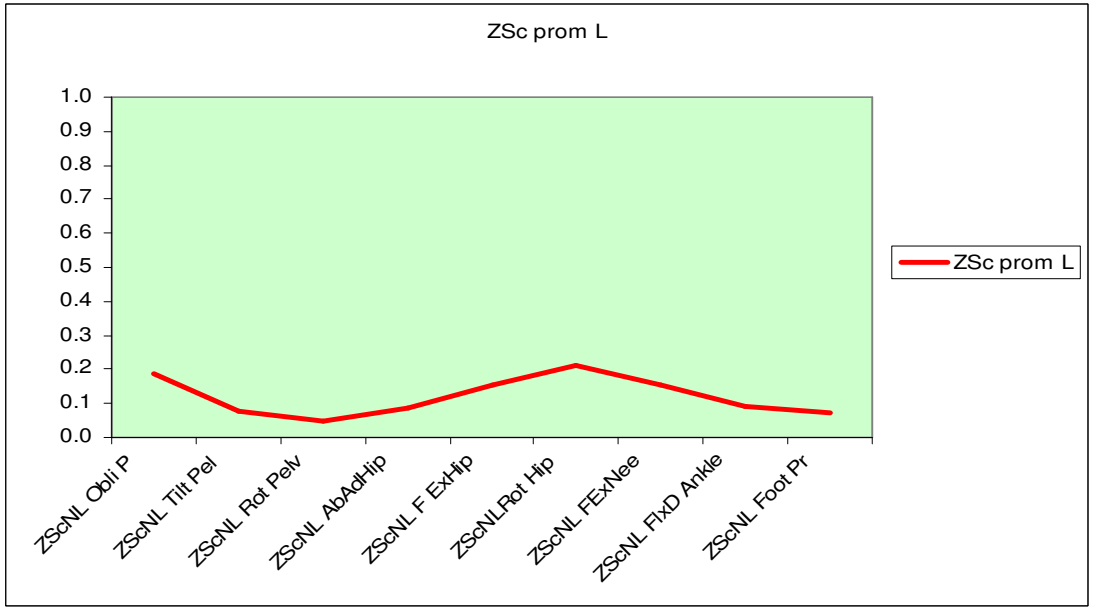
Z SCORE

ITALIAN REF SET VS GROUP OF NORMAL SUBJECTS

ZSCORE R	ZSc prom R
ZScNOblicPel R	0,124
ZScNR Tilt Pelv	0,137
ZScNR Rot Pelv	0,062
ZScNR AbAdHip	0,346
ZScNR F ExHip	0,311
ZScNR Rot Hip	0,090
ZScNR FExKnee	0,493
ZScNR FlxD Ankle	0,252
ZScNR Foot Pr	0,269
SUMA	2,085
PROMEDIO	**0,23**

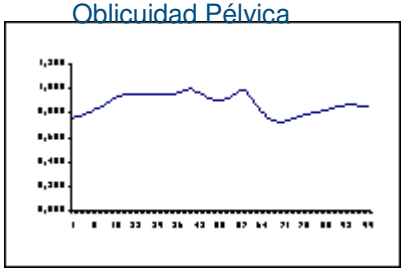
ZSCORE L	ZSc prom L
ZScNL Obli P	0,186
ZScNL Tilt Pel	0,077
ZScNL Rot Pelv	0,047
ZScNL AbAdHip	0,085
ZScNL F ExHip	0,152
ZScNLRot Hip	0,209
ZScNL FExNee	0,156
ZScNL FlxD Ankle	0,090
ZScNL Foot Pr	0,073
SUMA	1,075
PROMEDIO	**0,12**





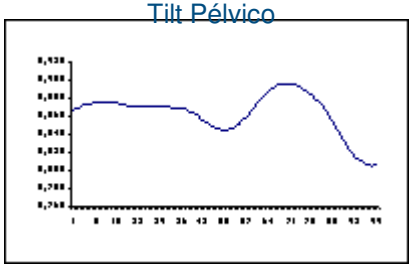
1- ZSC R

Oblicuidad Pélvica



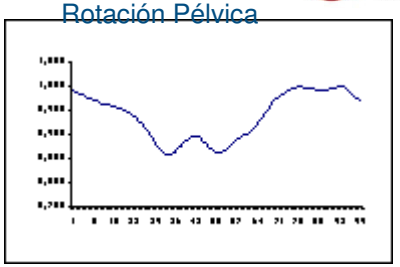
1-Zsc = 0,876

Tilt Pélvico



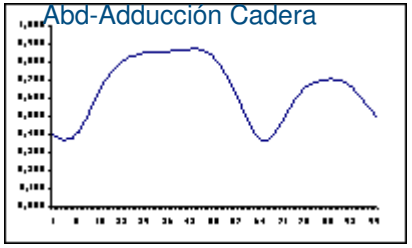
1-Zsc = 0,863

Rotación Pélvica



1-Zsc = 0,938

Abd-Adducción Cadera

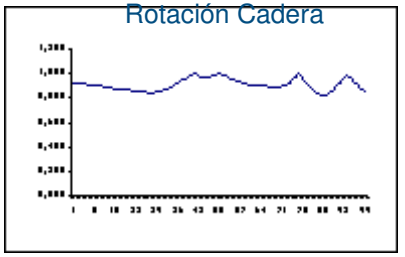


1-Zsc =0,654

Flex-Extensión Cadera

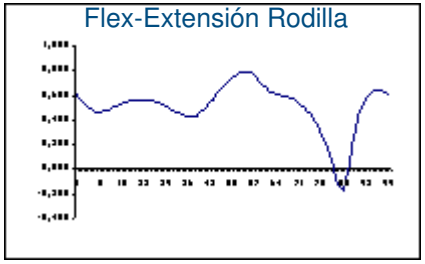
1-Zsc = 0,689

Rotación Cadera

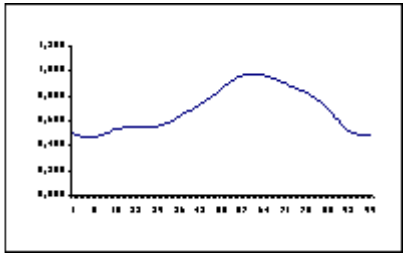


1-Zsc = 0,909

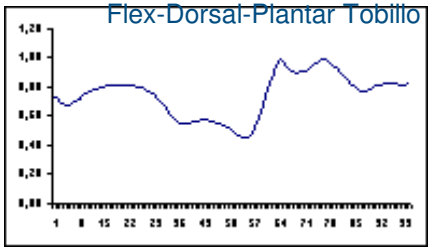
Flex-Extensión Rodilla



1-Zsc = 0,507

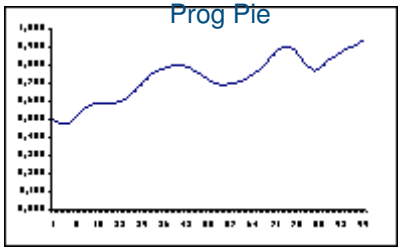


Flex-Dorsal-Plantar Tobillo



1-Zsc =0,748

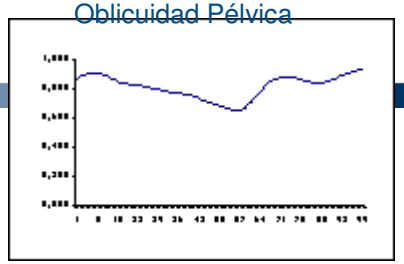
Prog Pie



1-Zsc =0,731

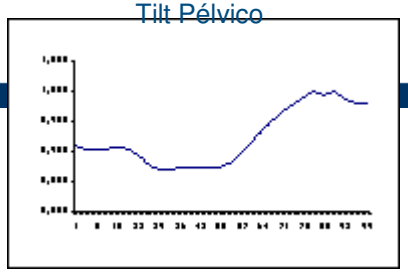
1-ZSC L

Oblicuidad Pélvica



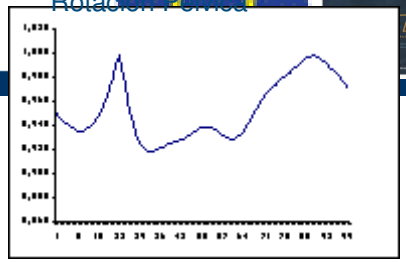
1-Zsc = 0,814

Tilt Pélvico



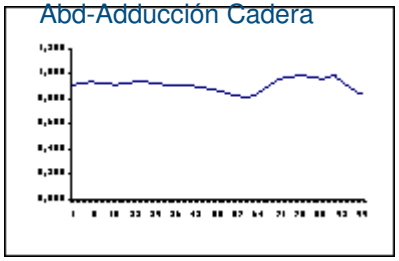
1-Zsc = 0,923

Rotación Pélvica



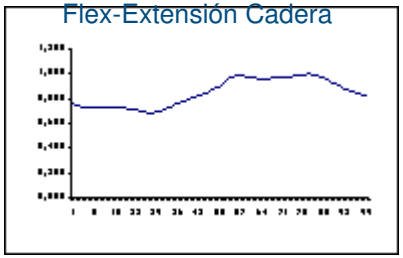
1-Zsc =0,953

Abd-Adducción Cadera



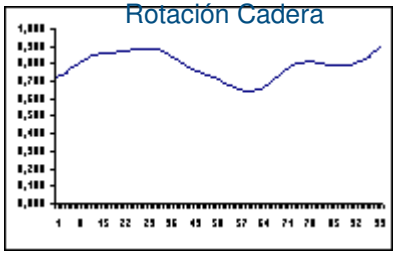
1-Zsc = 0,915

Flex-Extensión Cadera



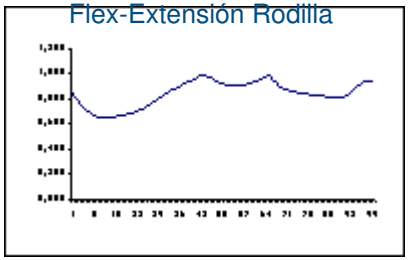
1-Zsc =0,848

Rotación Cadera



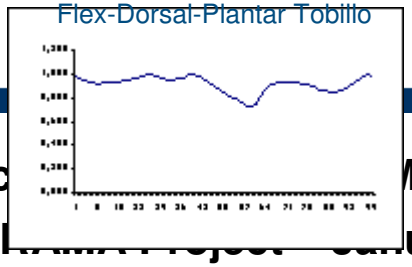
1-Zsc =0,791

Flex-Extensión Rodilla



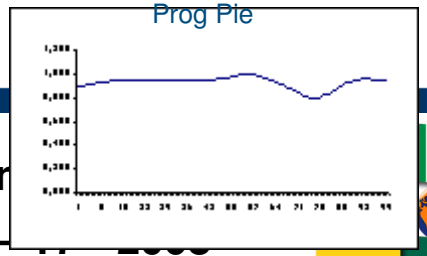
1-Zsc = 0,844

Flex-Dorsal-Plantar Tobillo



1-Zsc = 0,090

Prog Pie

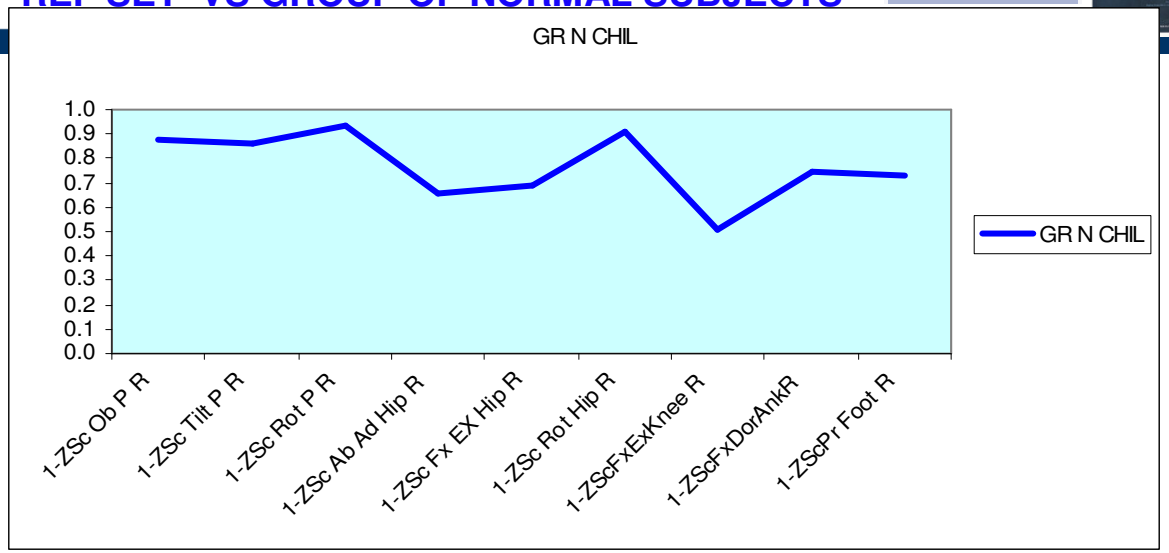


1-Zsc = 0,927

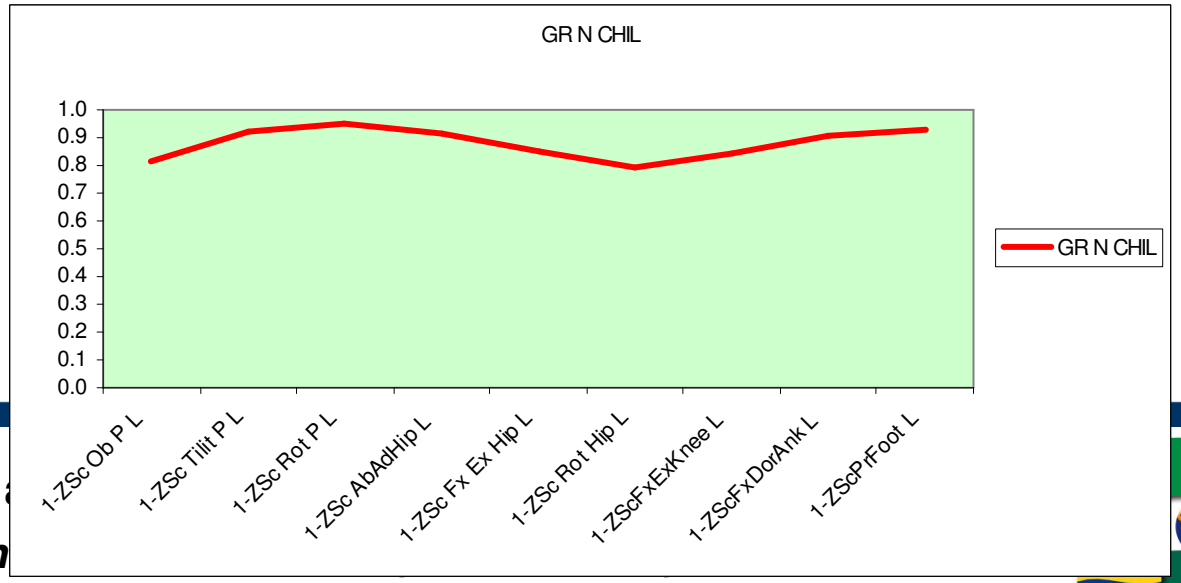
SUPPLEMENT Z SCORE (1-ZSc)

ITALIAN REF SET VS GROUP OF NORMAL SUBJECTS

COMP ZSC R	GR N CHIL
1-ZSc Ob P R	0,876
1-ZSc Tilt P R	0,863
1-ZSc Rot P R	0,938
1-ZSc Ab Ad Hip R	0,654
1-ZSc Fx EX Hip R	0,689
1-ZSc Rot Hip R	0,909
1-ZScFxExKnee R	0,507
1-ZScFxDorAnkR	0,748
1-ZScPr Foot R	0,731
SUMA	6,914
PROMEDIO	**0,77**

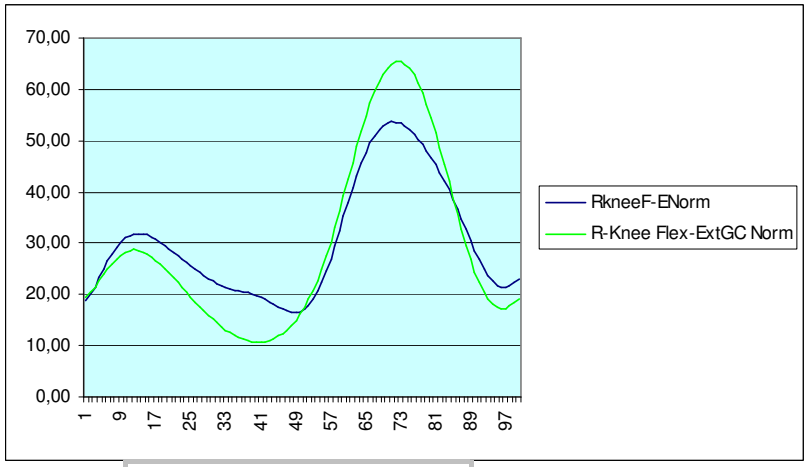


COMP ZSC L	GR N CHIL
1-ZSc Ob P L	0,814
1-ZSc Tilit P L	0,923
1-ZSc Rot P L	0,953
1-ZSc AbAdHip L	0,915
1-ZSc Fx Ex Hip L	0,848
1-ZSc Rot Hip L	0,791
1-ZScFxExKnee L	0,844
1-ZScFxDorAnk L	0,910
1-ZScPrFoot L	0,927
SUMA	7,925
PROMEDIO	**0,88**

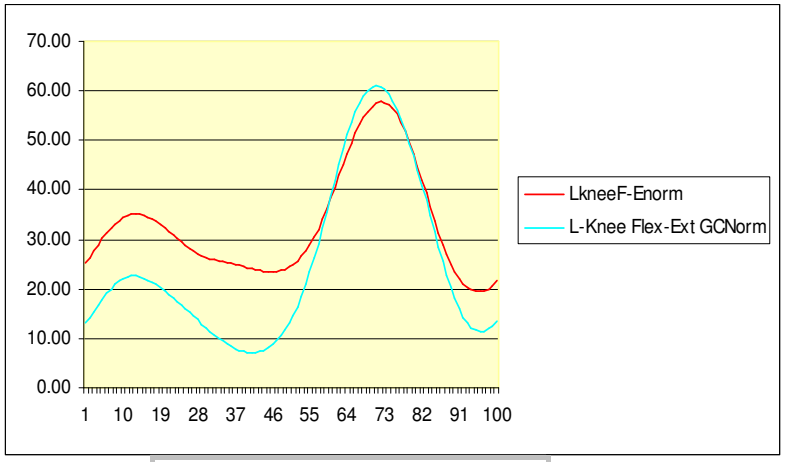


otion Analysis
esen

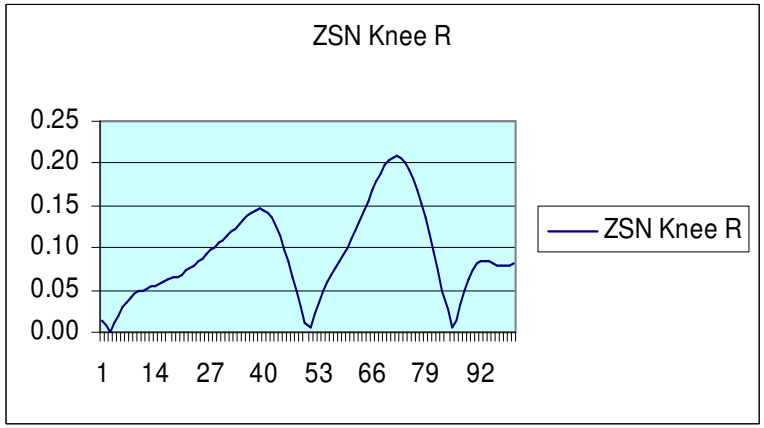
CORRELATION COEFFICIENT AND ZSCORE IN THE KNEE JOINT IN AN WALK CYCLE

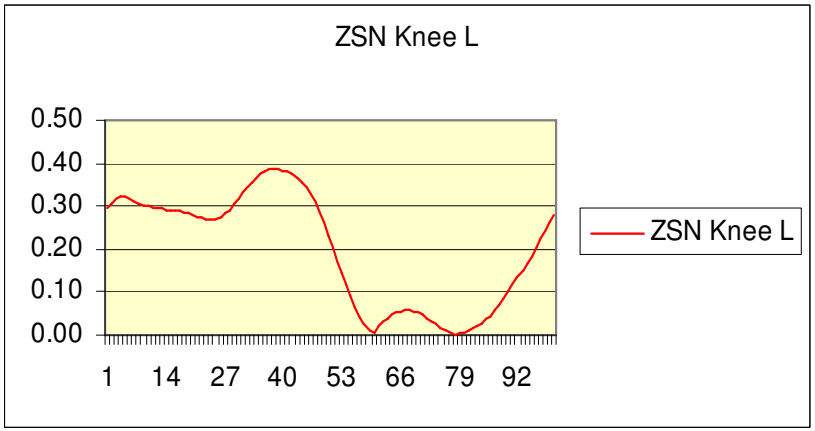


0.98



0.97





Prom ZSN 0,09

Prom ZSN 0,20

APPLICATIONS

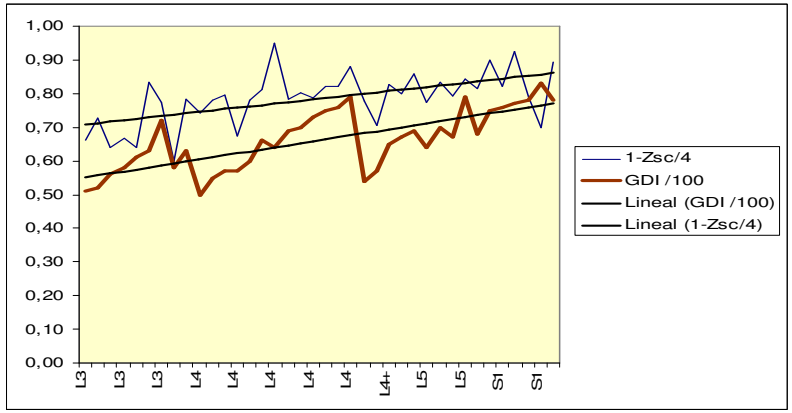
Were considered in the study 19 patients with MMC. We proceeded to distribute them in 4 groups according to the level of motor commitment of both limbs, right and left:

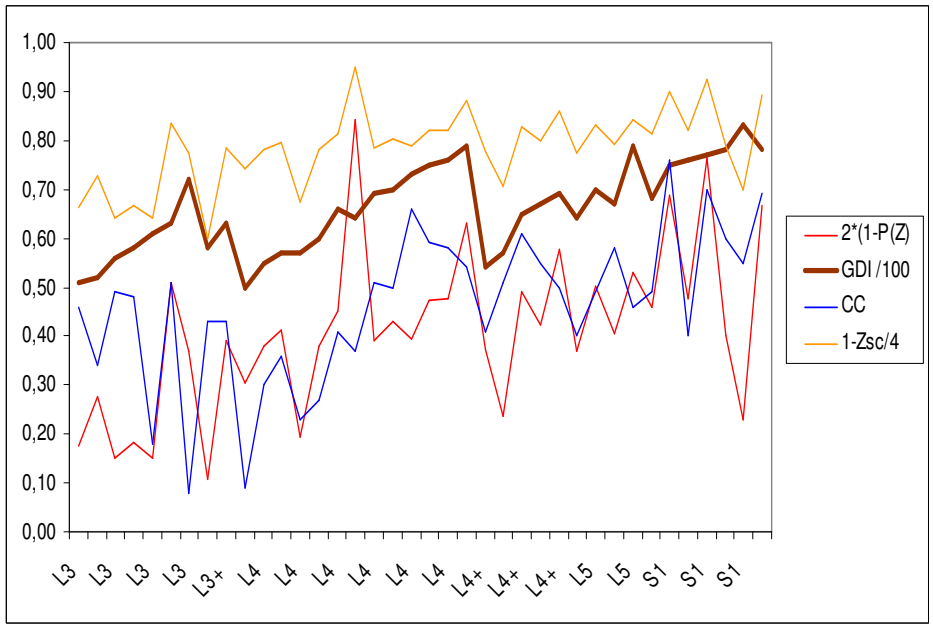
Group	Levels	limbs
G1	L3	7
	L3+	2
G2	L4	13
	L4+	5
G3	L5	4
G4	S1	6
	S2+	1
	Total	38

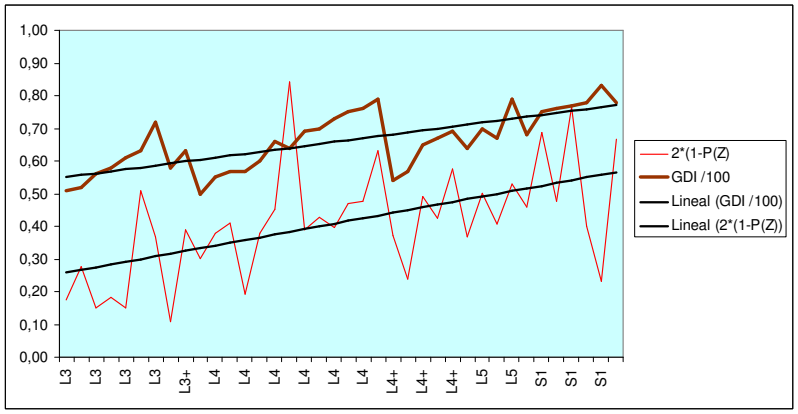
RESULTS

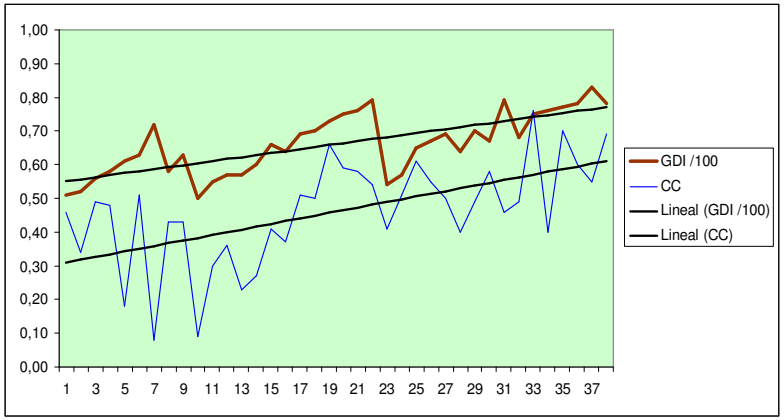
PACIENTES	CC	1-Zsc/4	GDI/100	(1-P(Z)	2*(1-P(Z)	NIVEL	Nº
2460XA06	0,46	0,66	0,51	0,09	0,18	L3	
2460XA06	0,34	0,73	0,52	0,14	0,28	L3	
2502XA01	0,49	0,64	0,56	0,07	0,15	L3	
2473XA05	0,48	0,67	0,58	0,09	0,18	L3	
2167xa02	0,18	0,64	0,61	0,07	0,15	L3	
2466XA01	0,51	0,84	0,63	0,25	0,51	L3	
2167xa02	0,08	0,78	0,72	0,18	0,37	L3	7
2467XA01	0,43	0,60	0,58	0,05	0,11	L3+	
2412XA06	0,43	0,79	0,63	0,19	0,39	L3+	2
2502XA01	0,09	0,74	0,50	0,15	0,30	L4	
2785xa07	0,30	0,78	0,55	0,19	0,38	L4	
2412XA06	0,36	0,80	0,57	0,21	0,41	L4	
2785xa07	0,23	0,68	0,57	0,10	0,19	L4	
2473XA05	0,27	0,78	0,60	0,19	0,38	L4	
2687XA04	0,41	0,81	0,66	0,23	0,45	L4	
2552XA04	0,37	0,95	0,64	0,42	0,84	L4	
2466XA01	0,51	0,79	0,69	0,19	0,39	L4	
2467XA01	0,50	0,80	0,70	0,21	0,43	L4	
2214xa03	0,66	0,79	0,73	0,20	0,40	L4	
2671XA02	0,59	0,82	0,75	0,24	0,47	L4	
2737XA02	0,58	0,82	0,76	0,24	0,48	L4	
2214xa03	0,54	0,88	0,79	0,32	0,63	L4	13
2671XA02	0,41	0,78	0,54	0,19	0,37	L4+	
2764xa03	0,51	0,71	0,57	0,12	0,24	L4+	
2764xa03	0,61	0,83	0,65	0,25	0,49	L4+	
2472XA05	0,55	0,80	0,67	0,21	0,42	L4+	
2472XA05	0,50	0,86	0,69	0,29	0,58	L4+	5
2552XA04	0,40	0,78	0,64	0,18	0,37	L5	
2737XA02	0,49	0,83	0,70	0,25	0,50	L5	
2687XA04	0,58	0,79	0,67	0,20	0,41	L5	
2118XA02	0,46	0,84	0,79	0,26	0,53	L5	4
2481XA02	0,49	0,82	0,68	0,23	0,46	S1	
2447xa04	0,76	0,90	0,75	0,34	0,69	S1	
2481XA02	0,40	0,82	0,76	0,24	0,48	S1	
2447xa04	0,70	0,93	0,77	0,38	0,76	S1	
2422xa03	0,60	0,79	0,78	0,20	0,40	S1	
2422xa03	0,55	0,70	0,83	0,12	0,23	S1	6
2118XA02	0,69	0,89	0,78	0,33	0,67	S2+	1

CURVES OF STATISTICS FUNCTIONS APPLIED VS FUNCTIONAL MOTORS LEVELS IN STUDY

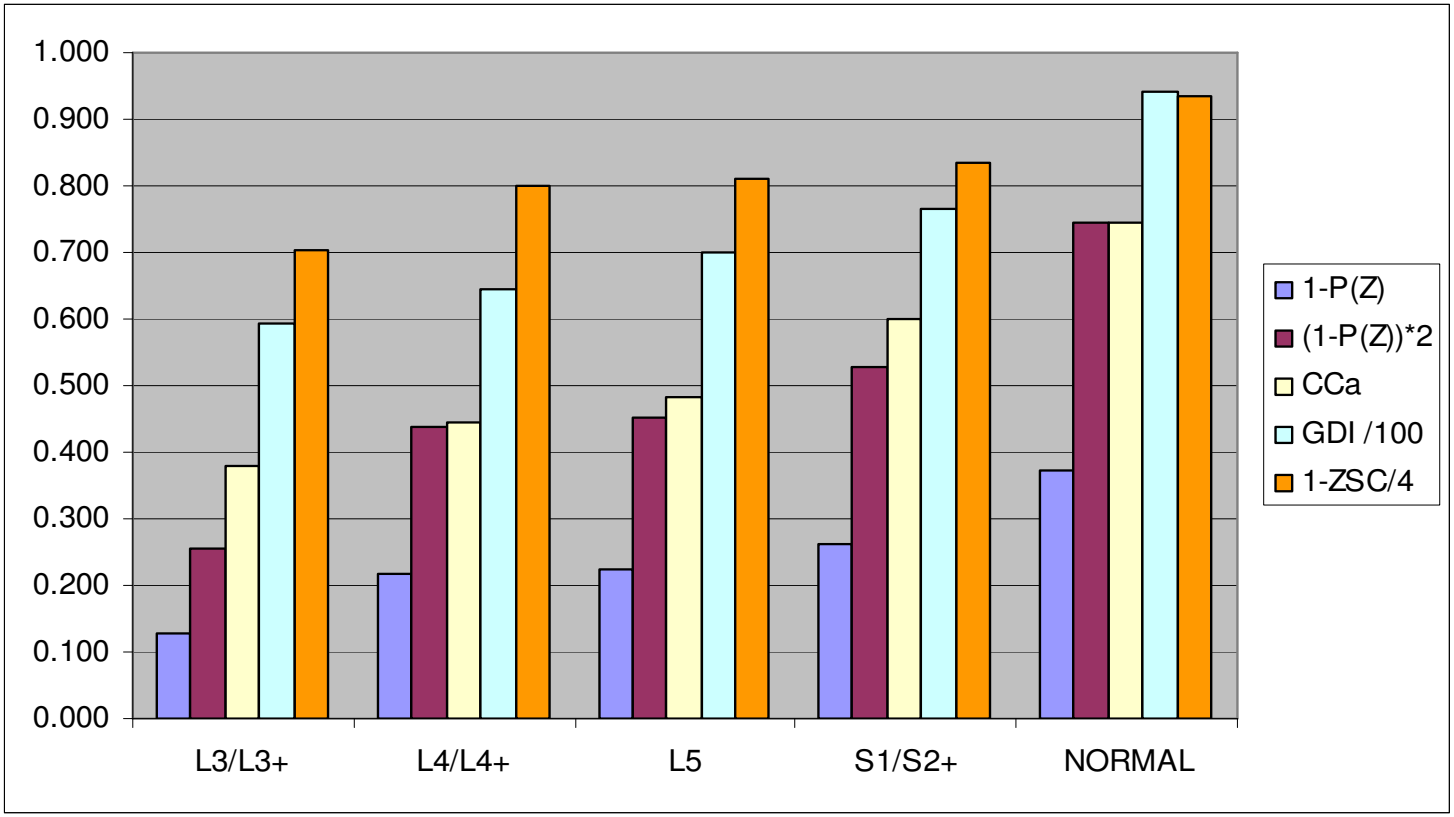




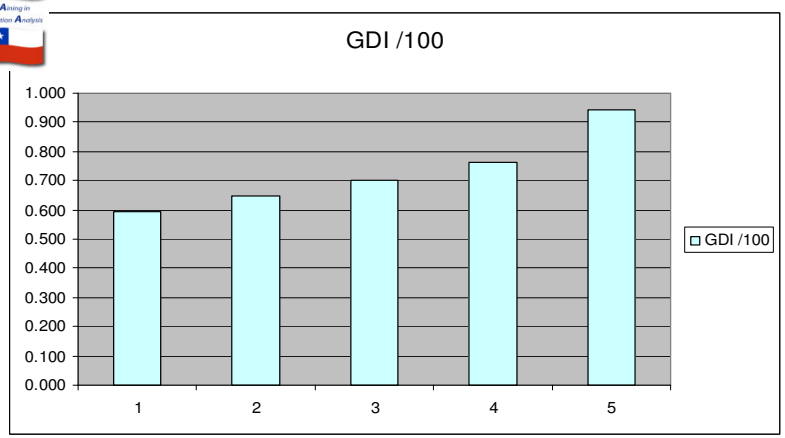


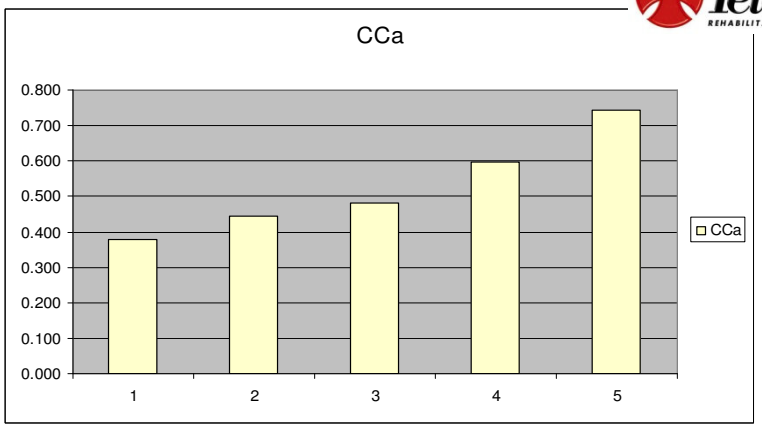


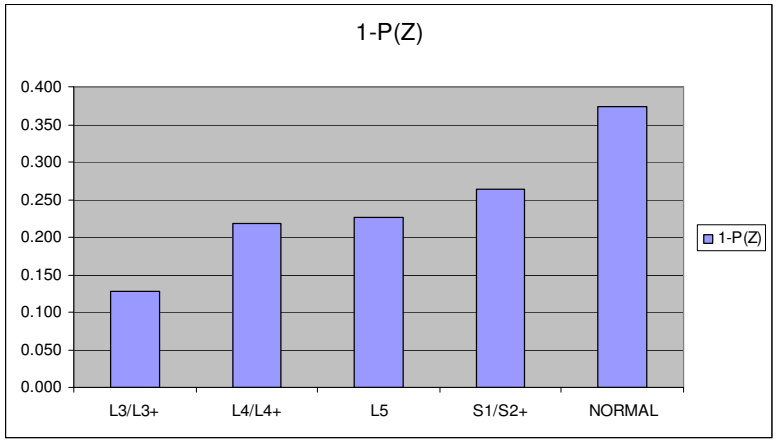
Graph of the average “1-P (Z)”, “(1-P(Z))*2”, “CCa”, “GDI/100”, “1 - Zsc / 4”, applied to the 5 groups of motors levels

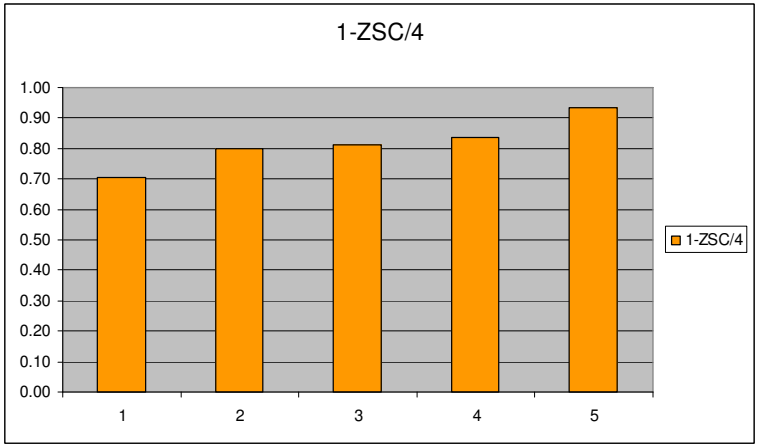


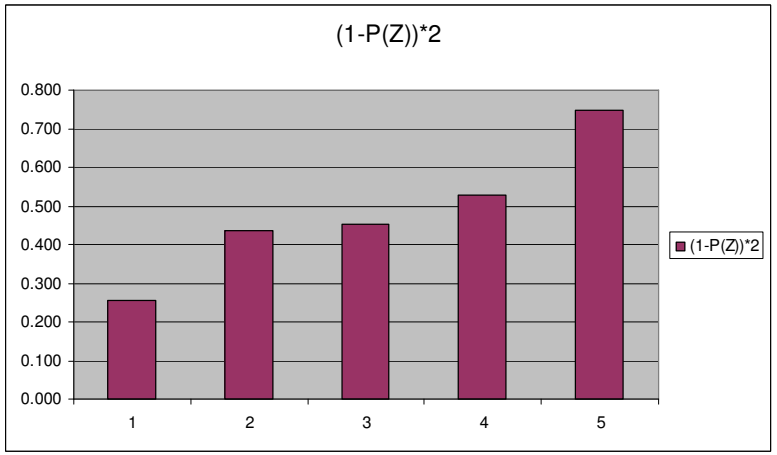
NIVEL	CC	ZSC	1-ZSC/4	GDI	GDI /100	P(Z)	1-P(Z)	(1-P(Z))*2
L3/L3+	0.38	1.19	0.70	59.35	0.59	0.87	0.13	0.26
L4/L4+	0.44	0.80	0.80	64.60	0.65	0.78	0.22	0.44
L5	0.48	0.76	0.81	70.07	0.70	0.77	0.23	0.45
S1/S2+	0.60	0.66	0.84	76.52	0.76	0.74	0.26	0.53
NORMAL	0.74	0.27	0.93	94.24	0.94	0.63	0.37	0.75

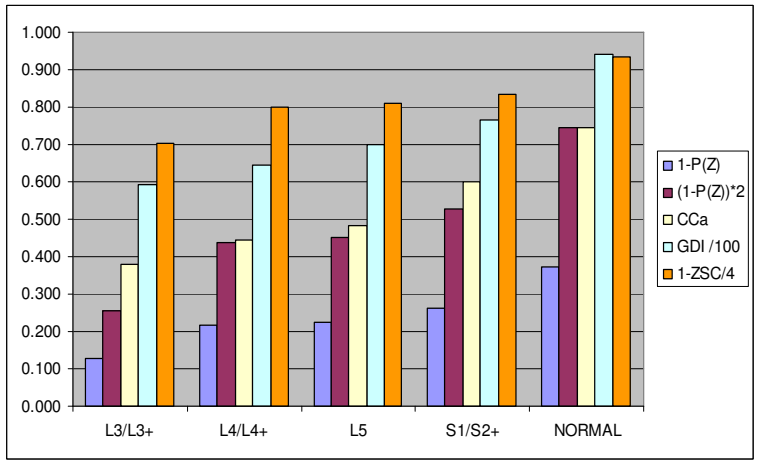

GDI /100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1
2
3
4
5
GDI /100


CCa
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1
2
3
4
5
CCa

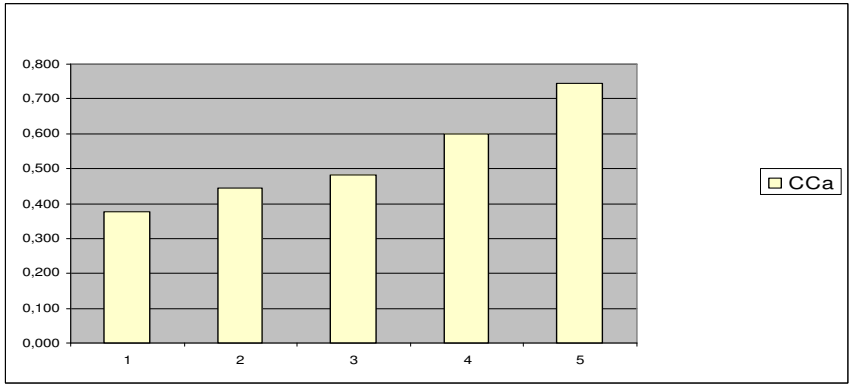

1-P(Z)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
L3/L3+
L4/L4+
L5
S1/S2+
NORMAL
1-P(Z)

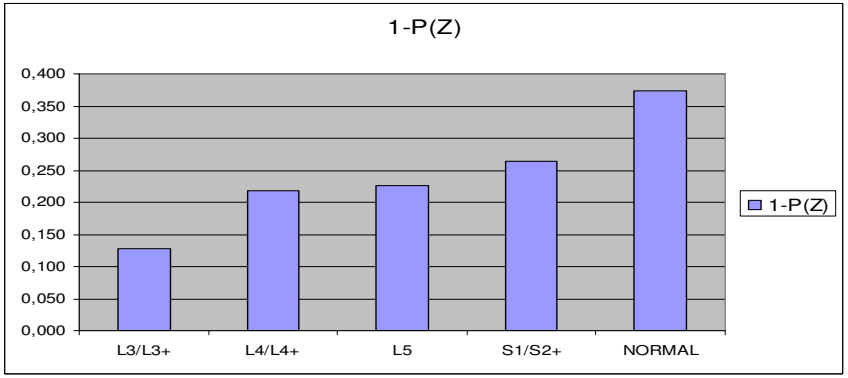

1-ZSC/4
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
2
3
4
5
1-ZSC/4


(1-P(Z))*2
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1
2
3
4
5
(1-P(Z))*2


1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
L3/L3+
L4/L4+
L5
S1/S2+
NORMAL
1-P(Z)
(1-P(Z))*2
CCa
GDI /100
1-ZSC/4

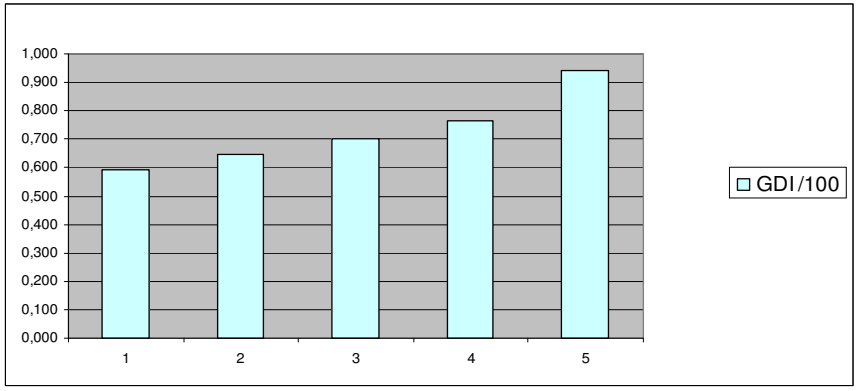
CC	CCa	1-ZSC/K	GDI/100	1-P(Z)	(1-P(Z))*2
Cca	1,000	0,951	0,991	0,971	0,971
1-ZSC/K		1,000	0,955	0,996	0,996
GDI/100			1,000	0,974	0,974
1-P(Z)				1,000	1,000
(1-P(Z))*2					1,000

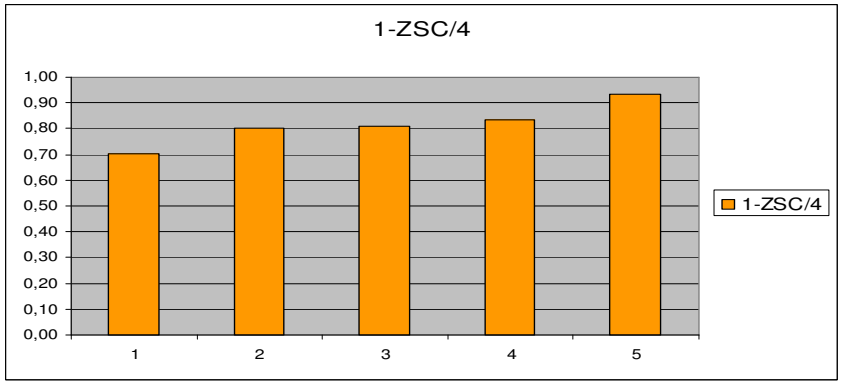




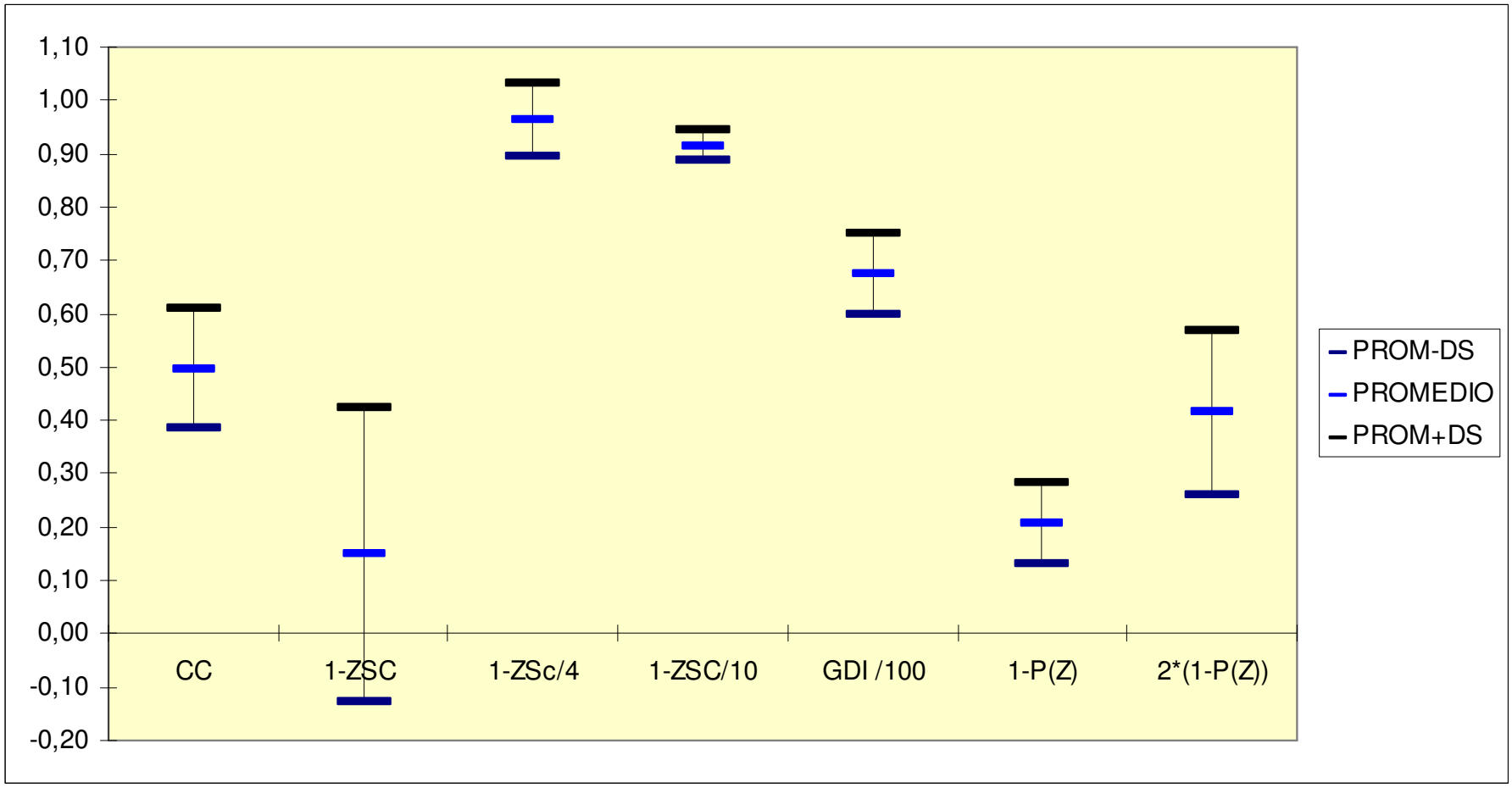
CC = 0,991

CC = 0,996





Mean values, (+/-) standard deviations of each function, applied to different motor levels of the study



RESULTADOS PRELIMINARES

- Las Funciones de Correlación, 1-(ZSc/k) y 1-P(Z), mantienen una misma tendencia al ser comparadas una a una con DGI.
- Al comparar entre sí los promedios totales de los resultados, relativos a cada una de las funciones además del promedio total del GDI, se obtiene que 1-P(Z) vs 1-(ZSc/k), tienen la mayor correlación de 0,996, sin embargo, las relaciones cruzadas entre ellas, son superior a 0,95.

- La función que más discrimina entre el mayor y menor compromiso motor es 1-ZSc, seguido de 2*(1-P(Z)), CCa, GDI/100 y finalmente los 1-Zsc/k .

FUTURE PROJECTIONS

LISSAJOUS FIGURES APPLICATION

i) COMPARATIVE STUDY OF SIGNALS

Kinematics projects in the same reference planes (phase angle measurement)

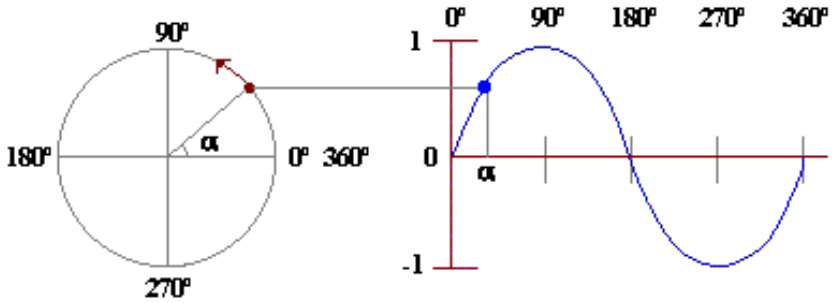
ii) DISPLACEMENT OF SACRED STUDIES

Implemented in perpendicular planes

LISSAJOUS FIGURES

A Lissajous figure is the trajectory of a moving point whose rectangular coordinates are simple harmonic motions.

The equation of simple harmonic motion can be expressed by: $x(t) = A \sin(\omega t \pm \varphi)$



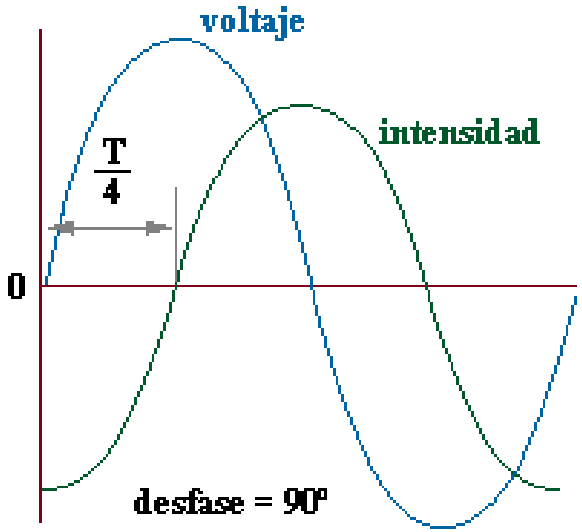
t : time

A : amplitude

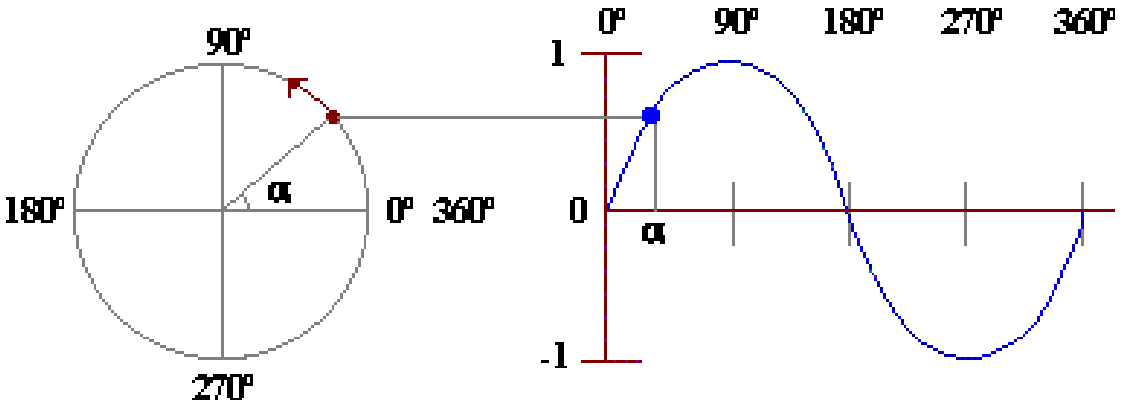
ω : angular frequency or angular velocity

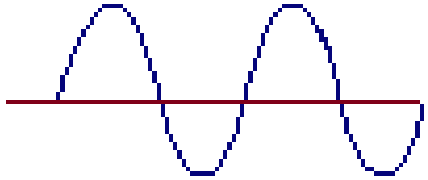
φ : phase or lag.

DELAY

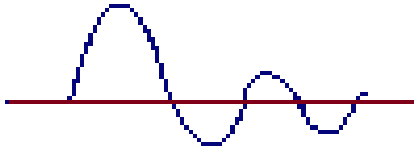


SINUSOIDAL FUNCTIONS



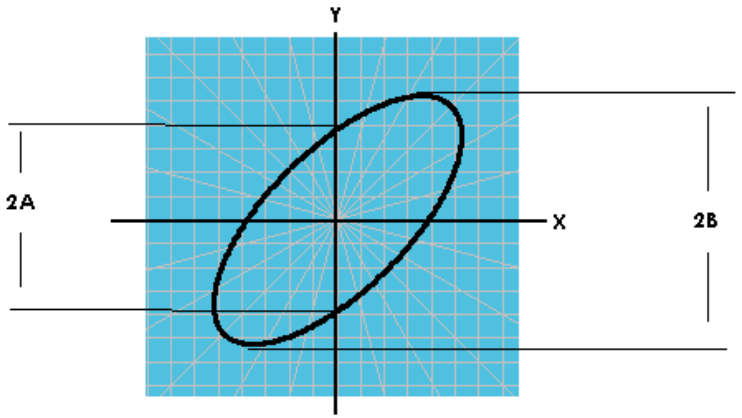


Onda senoidal



Onda senoidal amortiguada

ANGLE MEASUREMENT OR CALCULATION OF DELAY

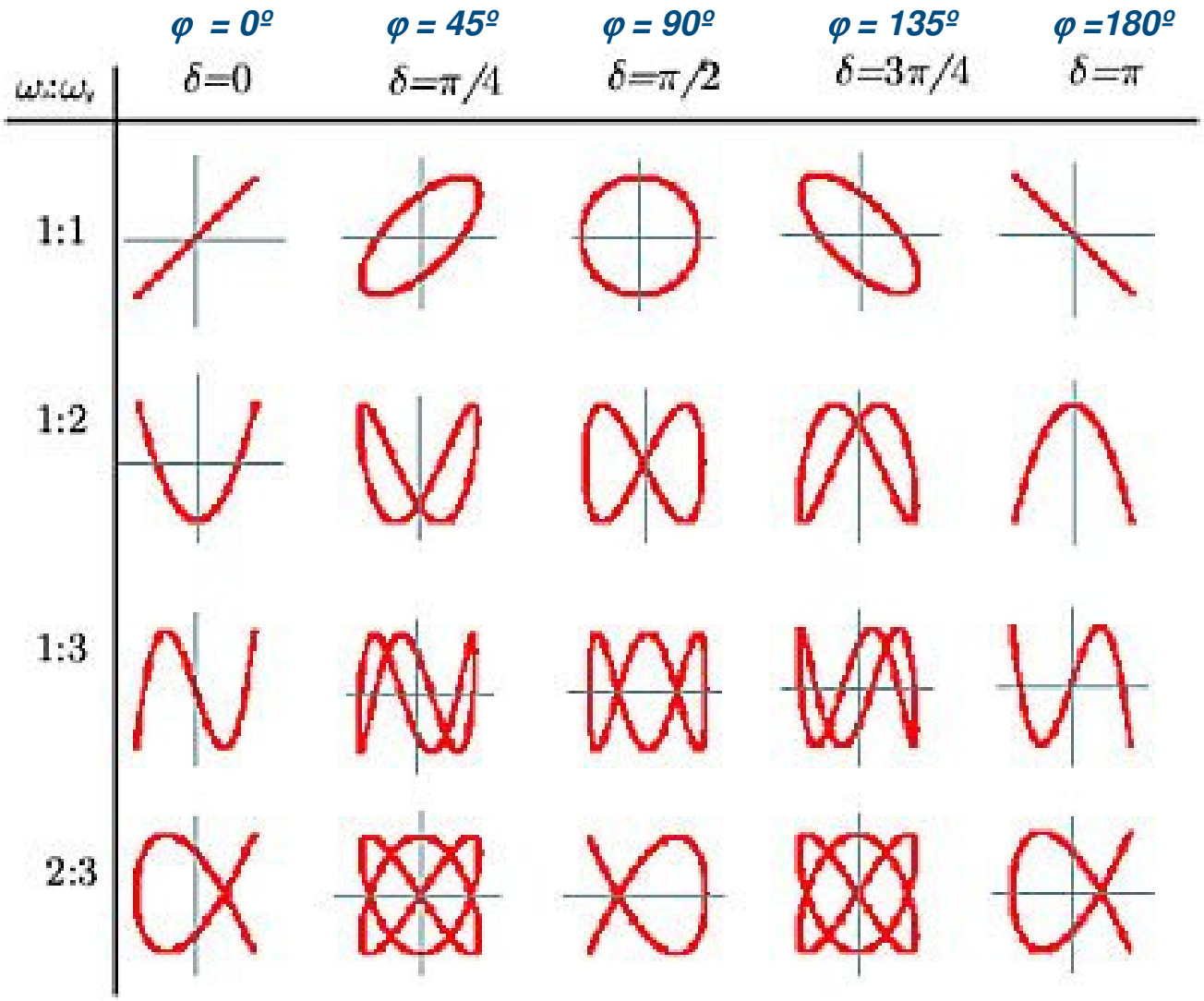


$X = A\ sen(\omega t)$ y $Y = B\ sen(\omega t \pm \varphi)$

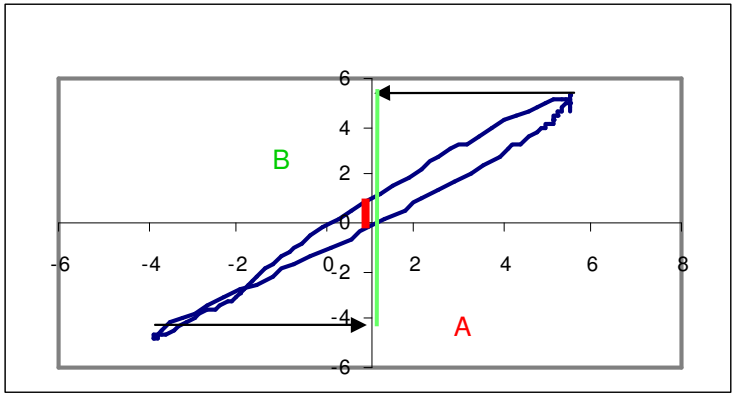
The phase of the Lissajous figure is calculated through the equation:

$$A/B = sen\ \varphi \quad => \quad \varphi = arc\ sen\ (A/B)$$

RELATIONSHIP BETWEEN SIGNALS OF DIFFERENT FREQUENCIES

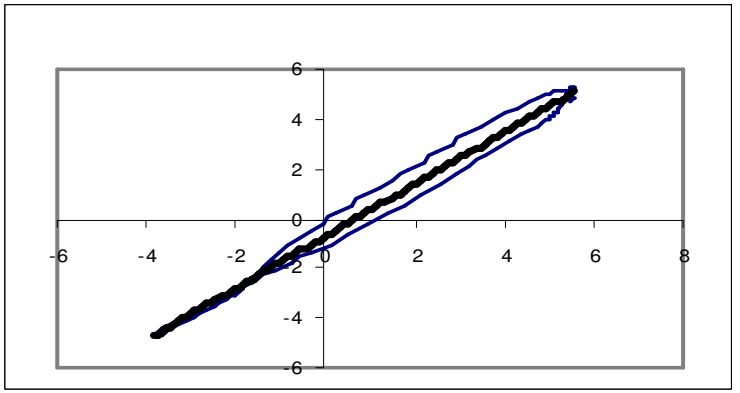


ROT PELV



CC = 0,99 φ = 6º

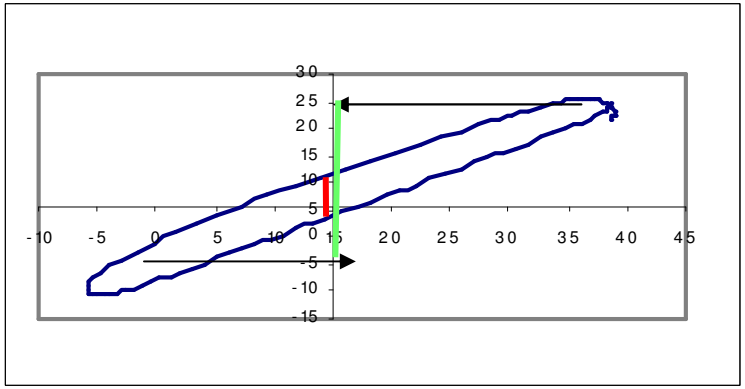
ROT PELV



φ = ***arc sen*** (***A/B***)

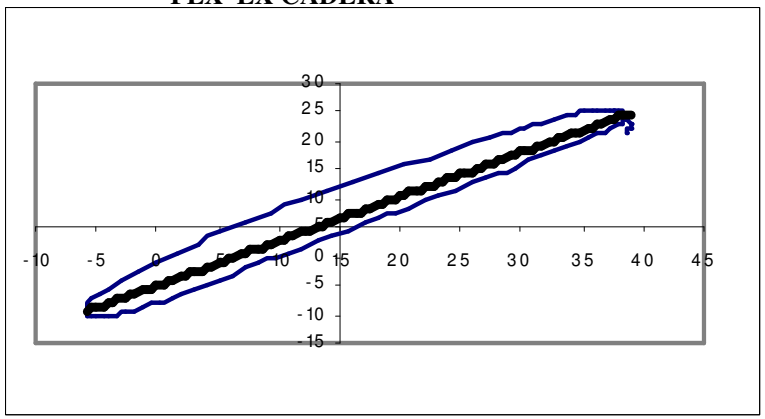
φ = ***arc sen*** (1/10) = 6º

FLX EX CADERA



CC = 0,97 φ = 10º

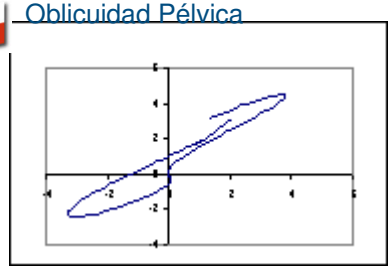
FLX EX CADERA



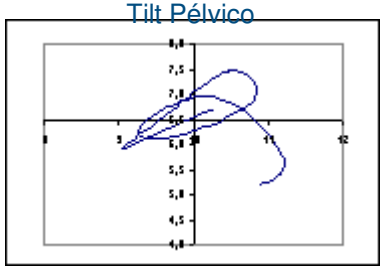
φ = ***arc sen*** (6/35) = 10º

LISSAJOUS R

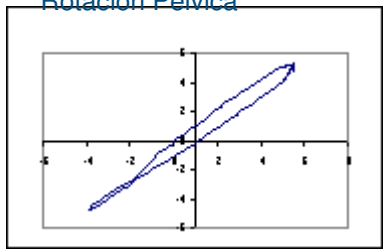
Oblicuidad Pélvica



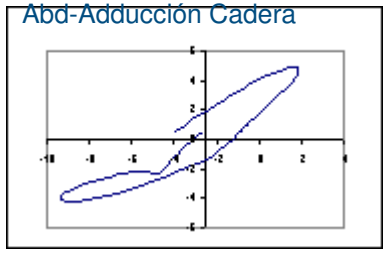
Tilt Pélvico



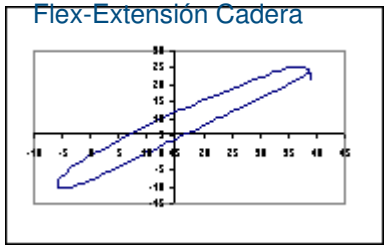
Rotación Pélvica



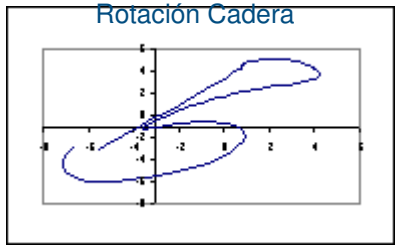
Abd-Adducción Cadera



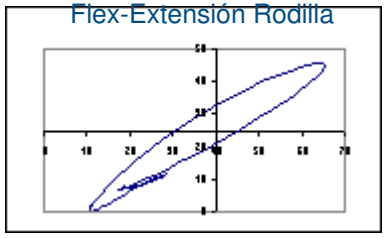
Flex-Extensión Cadera



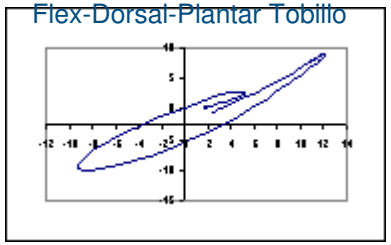
Rotación Cadera



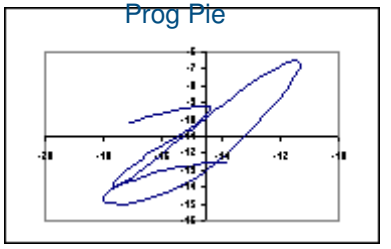
Flex-Extensión Rodilla



Flex-Dorsal-Plantar Tobillo

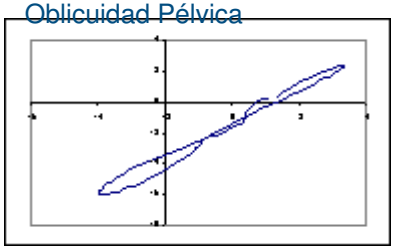


Prog Pie

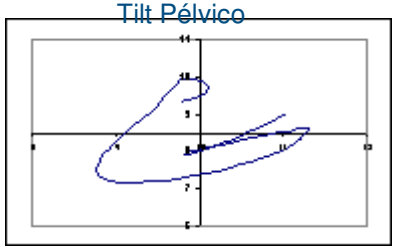


LISSAJOUS L

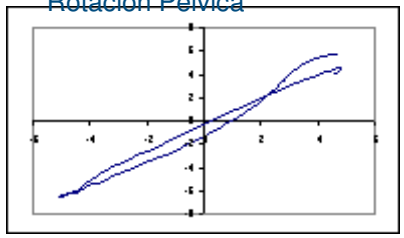
Oblicuidad Pélvica



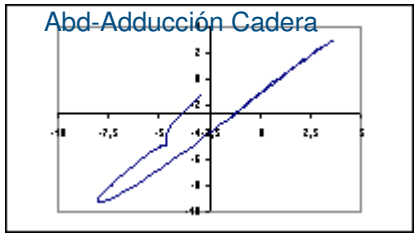
Tilt Pélvico



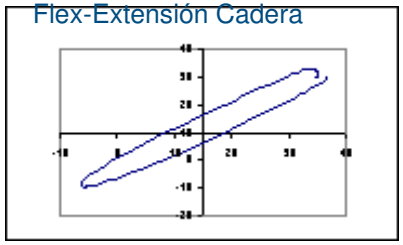
Rotación Pélvica



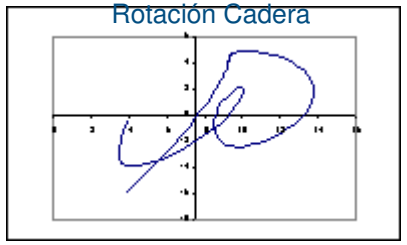
Abd-Adducción Cadera



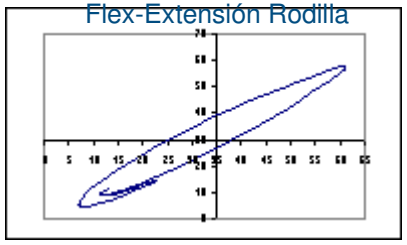
Flex-Extensión Cadera



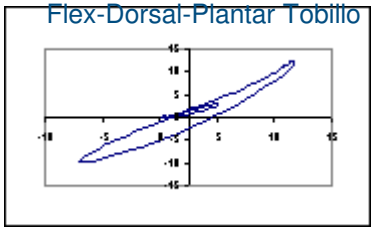
Rotación Cadera



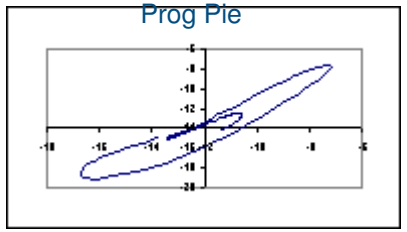
Flex-Extensión Rodilla



Flex-Dorsal-Plantar Tobillo

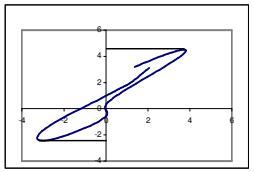


Prog Pie



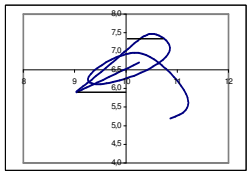
FIGURAS DE LISSAJOUS DE SET REF ITALIANO VS GRUP NORMAL CHILENO
EXTREMIDAD DERECHA

OBL PELV



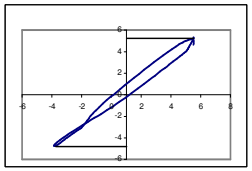
0,96 16º

TILT PELV



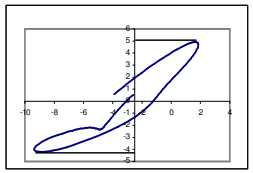
0,11 49º

ROT PELV



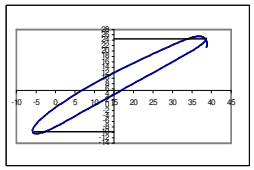
0,99 6º

AB AD CAD



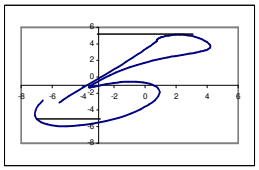
0,93 23º

FLX EX CAD



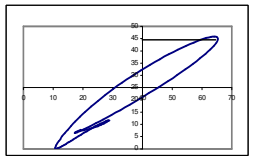
0,97 10º

ROT CADER



0,80 33º

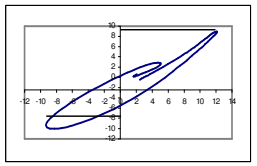
FLX EX ROD



0,97 15º

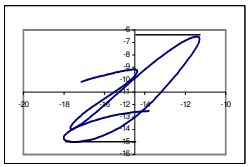
PROM CC R	0,84

FLX DOR TOB



0,96 16º

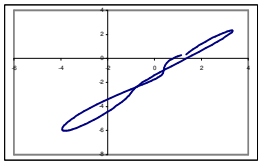
PROG PIE



0,83 21º

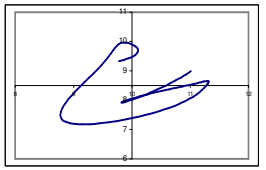
FIGURAS DE LISSAJOUS DE SET REF ITALIANO VS GRUP NORMAL CHILENO
EXTREMIDAD IZQUIERDA

OBL PELV



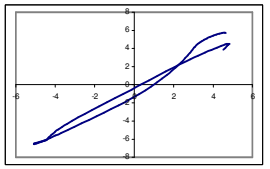
0,99 14º

TILT PELV



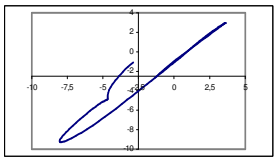
0,15 46º

ROT PELV



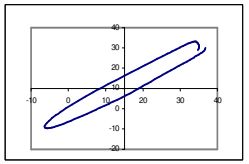
0,99 9º

AB AD CAD



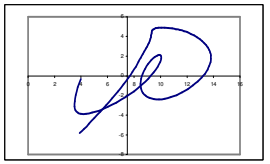
0,98 14º

FLX EX CAD



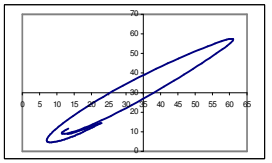
0,97 17º

ROT CADER



0,63 51º

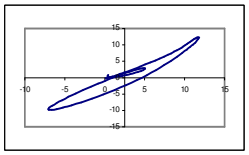
FLX EX ROD



0,97 14º

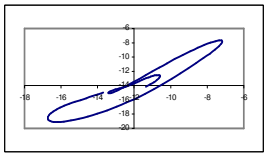
PROM CC L	0,85

FLX DOR TOB



0,98 11º

PROG PIE



0,95 13º

DISCUSSION

Increasing the number of patients to obtain an adequate sample and determine average values depending on the different levels of injury.
Correlating the results with the respective clinical evaluations.

CONCLUSIONS

The proposed method delivers 3 complementaries values easy to calculate.
When calculating the correlation coefficients at various levels of injury (S1, L3), it appears that their values fall and the dispersal of some of its points are increased in SD according to expectations, but the amount sample is still insufficient.

REFERENCE

[1] L.M.Schutte et al.”An index for quantifying deviations from normal gait”. Gillette Children’s Specialty Healthcare, St Paul, MN, USA.Gait and Posture 11(2000) 25-31.

[2] Michael H. Schwartz, Adam Rozumalski, “The gait deviation index: an new comprehensive index of gait pathology”. Gillette Children’s Specialty Healthcare, St Paul, MN, USA.Gait and Posture 28 (2008) 351-357.

[3] Richard Baker et al.”The gait profile Score and Movement Analysis Profile”. Gait and Posture 30 (2009) 265-269.

[4] F.G.Stremler. “ Introducción a los Sistemas de Comunicación”. University of Wisconsin, Madison. Addison-Wesley Iberoamericana S. A.Wilmington, Delaware, USA, 1993

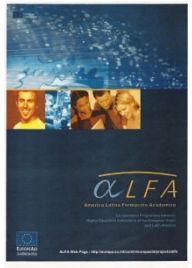
[5] R. G. D. Steel et al. “ Principles and Procedures of Statistics. A Biometrial Approach”. McGRAW-HILL Inc., 1985.

[6] D. O. Walter: “Digital Processing of Bioelectrical Phenomena, Part B, Space Biology Laboratory, University of California, Los Angeles, Calif. (U. S. A.) Hand Book of Electroencephalography and Clinical Neurophysiology, Elsevier Punlishing Company, Amsterdam- The Netherlands.

MAL Business Plan Simulation

TRAMA Network Project

October 14 - 17th 2009

Carlos Alvarez M., PT
Luis Briceño A.,Ing
Mariana Haro D., MD
Susana Lillo S., MD
Mónica Morante R., MD
Claudio Rozbaczylo F., PT

Instituto de Rehabilitación Infantil Teletón Chile