




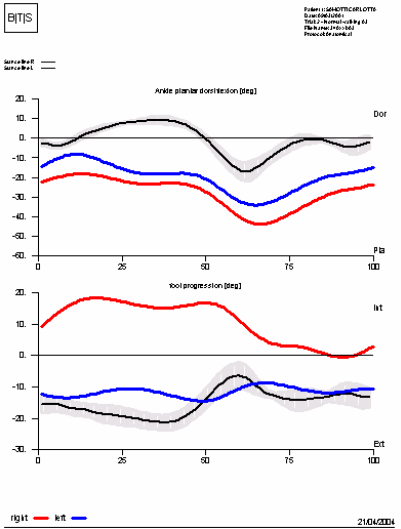
TRAMA *TR*aining in *M*otion *A*nalysis

"Basics in motion analysis "

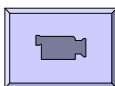
Kinematics of GAIT

Milan, September 10-21 Sept 2007

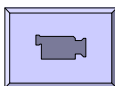
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Video







Scheletro



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Initial contact Loading Response Mid-Stance Terminal Stance Pre-Swing Initial Swing Mid-Swing Terminal Swing







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LEFT

HEEL STRIKE TOE OFF HEEL STRIKE







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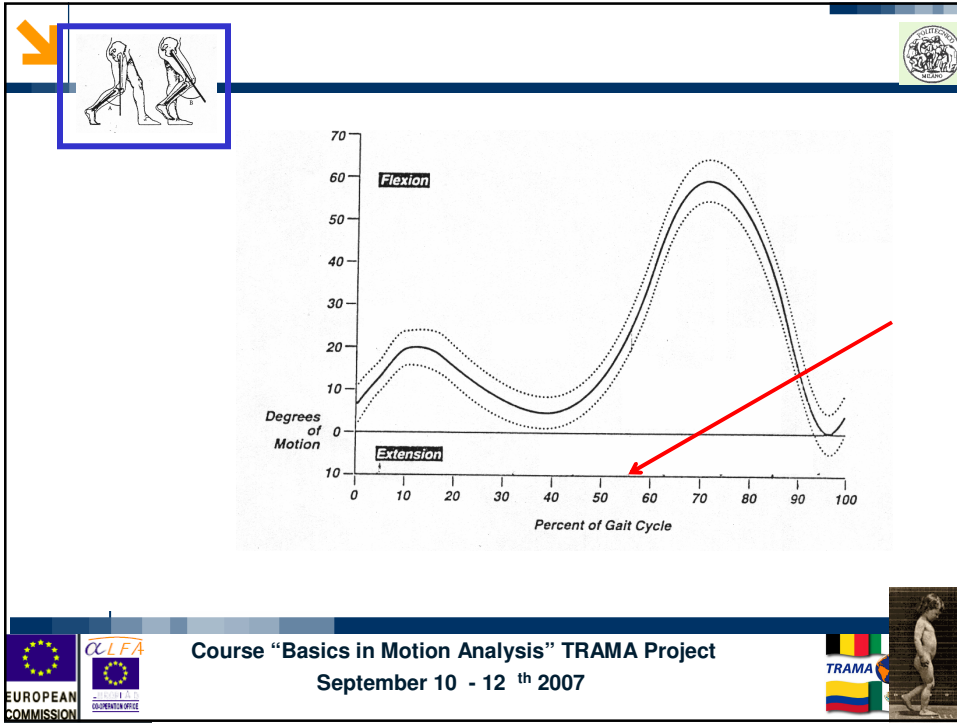
 **The report analysis** 

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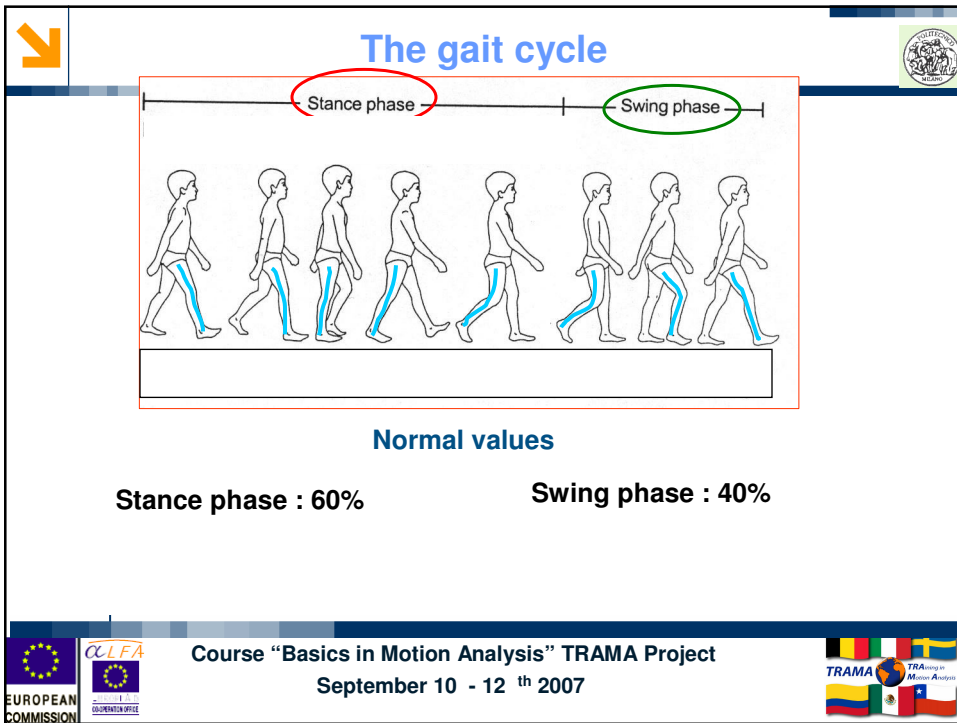
 

The spatial and temporal parameters

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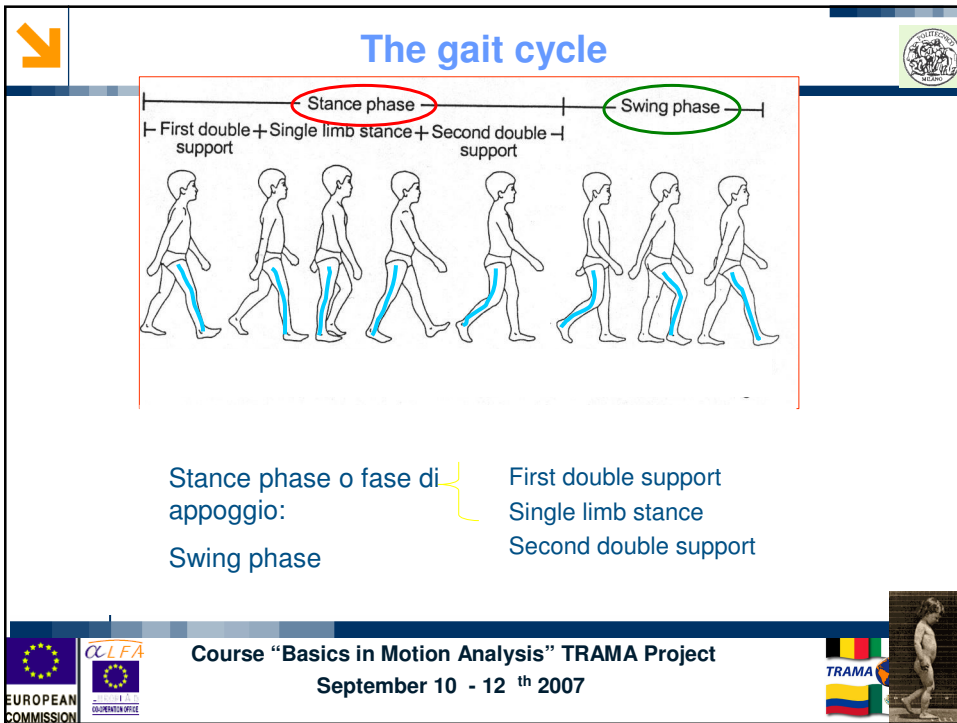
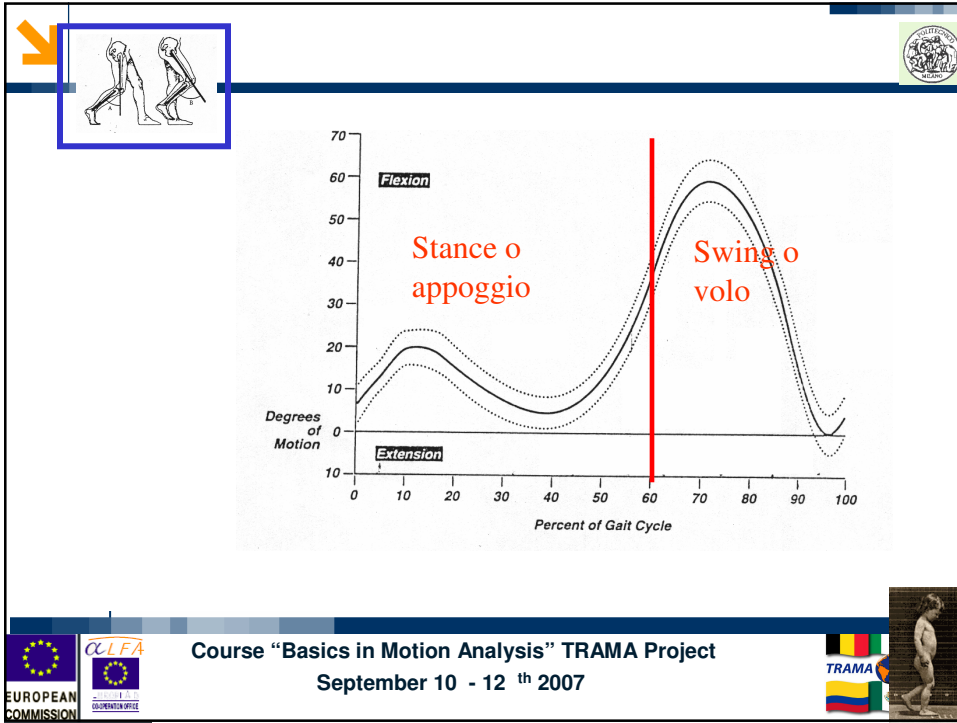


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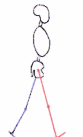


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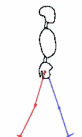





Fase di stance




HEEL-STRIKE (INITIAL CONTACT): inizia il ciclo del passo. Il COG assume la posizione più vicina al terreno



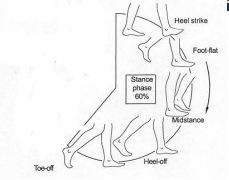
HEEL-OFF (TERMINAL STANCE): il tallone si solleva dal terreno e inizia la fase propulsiva causata dai muscoli posteriori della gamba che flettono la caviglia (NORMALI: 30% - 50% gait cycle)



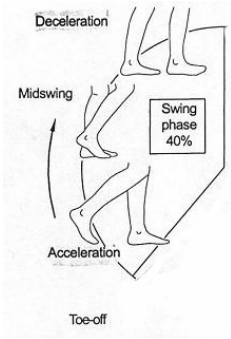
FOOT-FLAT (LOADING RESPONSE): la pianta del piede è completamente in contatto con il terreno (NORMALI: 0% - 10% gait cycle)




TOE-OFF (PRESWING): termina la fase di stance e il piede si stacca dal terreno (NORMALI: 50% - 60% gait cycle)




Stance phase 50%




Swing phase 40%



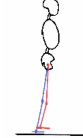
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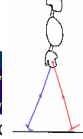
Fase di swing



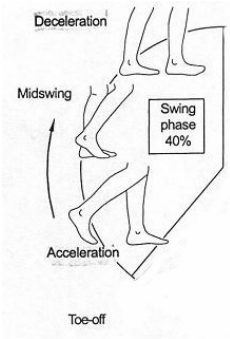
INITIAL SWING: l'arto si sposta in avanti appena dopo lo stacco del piede; viene impressa all'arto un'accelerazione nella direzione dell'avanzamento (NORMALI: 60% - 70% gait cycle)




MIDSWING: l'arto passa sotto il corpo. L'arto controlaterale è in midstance (NORMALI: 70% - 85% gait cycle)




TERMINAL SWING: l'arto continua il movimento in avanti e subisce una decelerazione per successive appoggi (NORMALI: 85% - 100% gait cycle)



Swing phase 40%



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Other quantities

Stridelenlength = Step_{Right} + Step_{Left}

Right steplength **Left steplength**

[cm]


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Normalization on subject high.

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↓

Step width




Step width [mm]

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↓

Cadence

Number of step per unit time
[step/min]


Walking speed

Cadence * step length = Vel [m/s]

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TRAMA



First sheet: Temporal parameters

BjTS

Report di Gait Analysis

Federico FALTRA ALESSANDR
 626040001
 7011 - Normal walking 05
 04/09/2001
 Proceed to work!!

Anamnestic Data
 Name: FALETRA ALESSANDR
 Pathology: NORMAL
 Age: 12
 Height: 159
 Weight (kg): 45

Clinicians
 External clinician:
 Internal clinician:

Report
 Trial types: 1 - Normal walking 05
 Date: 04/09/2001
 Notes: -

TEMPORAL

	RT	LT	RT	LT
Stance time [msec]	340	360	33-38	31-39
Swing time [msec]	390	41	33-38	31-39
Stance time [% stride]	39	41	37-40	31-37
Swing time [% stride]	41	39	33-38	31-39
Stride time [msec]	920	920	33-38	31-39
Cadence [steps/min]	130	130	110-130	110-130
Double supp. time [msec]	R-Fw	L-Fw	R-Fw	L-Fw
Double supp. [% stride]	4.8	4.7	4.8	4.7

	RT	LT	RT	LT
Anterior step length [m]	0.00	0.00	0.77-0.79	0.77-0.80
Velocity [m/sec]	0.00	1.45	0.97-1.00	0.98-1.01
Swing velocity [m/sec]	0.00	3.51	3.4-3.8	3.3-3.6
Stride length [m]	0.00	1320.94	0.9-1.000	0.919-1.000
Step width [m]	0.00	0.00	0.00-0.20	0.00-0.20
Mean velocity [m/sec]	1.45	1.45	0.97-1.01	0.98-1.01

Class Name: CHILDREN
Description: Gait Clinic - BTS S.p.A. 2009/2002

REPORTSX.REP Gait Clinic - BTS S.p.A. 1

Logos: EUROPEAN COMMISSION, CCLFA, TRAMA, TRAMA in Motion Analysis



TEMPORAL PARAMETERS

COMPOSITE AVERAGE NORMALS

	RIGHT	LEFT	RIGHT	LEFT
STANCE TIME [%]	61.1	63.6	55.6 ± .9	55.7 ± 2.9
SWING TIME [%]	38.9	36.4	44.4 ± .9	44.3 ± 2.9
STANCE TIME [s]	0.77	0.84	0.493 ± .056	0.554 ± .082
SWING TIME [s]	0.49	0.48	0.393 ± .044	0.436 ± .029
STRIDE TIME [s]	1.26	1.32	0.887 ± .099	0.99 ± .1
DOUBLE SUPPORT [%]	11.9	11.1	4.3 ± .6	5.7 ± 1.8
CADENCE [steps/min]	93.074		128.483 ± 14.925	



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SPATIAL PARAMETERS

	COMPOSITE AVERAGE NORMALS			
	RIGHT	LEFT	RIGHT	LEFT
STEP LENGTH [m]	0.469	0.405	0.545 ± .035	0.55 ± .023
VELOCITY [m/s]	0.686	0.668	1.224 ± .191	1.032 ± .185
SWING VELOCITY [m/s]	1.763	1.837	2.757 ± .419	2.324 ± .316
STRIDE LENGTH [m]	0.864	0.882	1.07 ± .074	1.007 ± .083
STEP WIDTH [m]	0.18	0.162	0.079 ± .013	0.082 ± .019
MEAN VELOCITY [m/sec]	0.677		1.114 ± .208	






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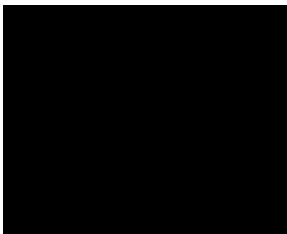
Clinical example

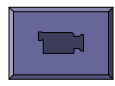
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Right hemiplegia 





H=123 cm





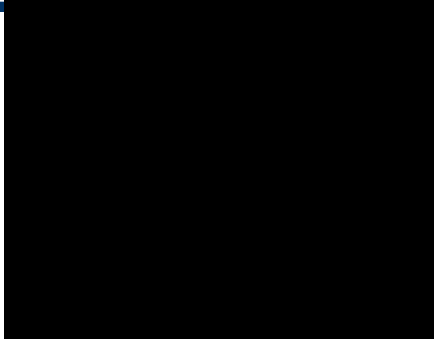
Stance phase right: 65% Stance phase left: 56%
 Swing phase dx: 35% Swing phase sx: 44%


Vel: 0.80 m/sec vs 1,15 m/sec





Step width 159 mm vs 130 mm norm
 Step length 846 mm a dx 852 mm a sx vs 1100 norm

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Diplegia (1922) 



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Principali alterazioni dei parametri spazio/temporali



VIDEO



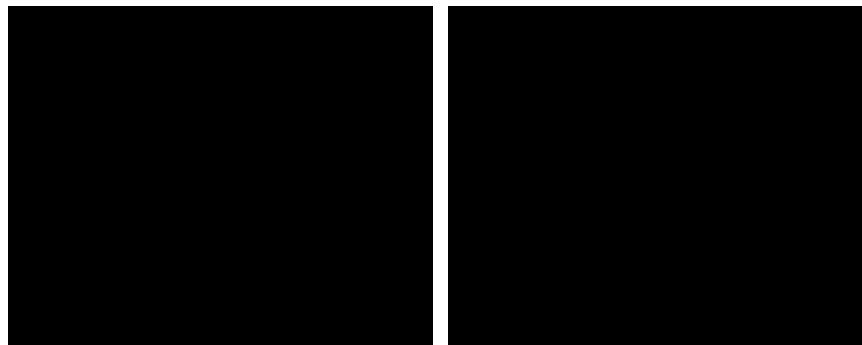
Pdf



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Senza tutori



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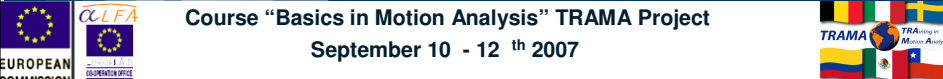


Senza tutori

NORMALITA'

<u>Parametri temporali</u>	<u>DX</u>	<u>SX</u>	<u>DX</u>	<u>SX</u>
Stance time [msec]	730	680	609 - 651	583 - 668
Swing time [msec]	510	500	410 - 442	406 - 452
Stance time [% stride]	59	58	58 - 61	57 - 61
Swing time [% stride]	41	42	39 - 42	39 - 43
Stride time [msec]	1240	1180	1030 - 1082	1003 - 1107
Cadence [step/min]		99	110 - 118	110 - 118
	<u>Fw Dx</u>	<u>Fw Sx</u>	<u>Fw Dx</u>	<u>Fw Sx</u>
Double supp. time [msec]	160	70	130 - 150	81 - 92
Double supp. [% stride]	13	6	12 - 14	8 - 9

<u>Parametri di distanza</u>	<u>DX</u>	<u>SX</u>	<u>DX</u>	<u>SX</u>
Step length [mm]	409	548	614.87 - 623.87	721.21 - 758.90
Velocity [m/sec]	0.78	0.79	1.27 - 1.39	1.27 - 1.40
Swing velocity [m/sec]	1.90	1.86	3.16 - 3.43	3.09 - 3.46
Stride length [mm]	968	928	1330.43 - 1478.14	1342.45 - 1462.14
Step width [mm]		220	98.48 - 139.22	98.48 - 139.22
Mean velocity [m/sec]		0.78	1.27 - 1.39	1.27 - 1.39



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Con tutori


NORMALITA'





<u>Parametri temporali</u>	<u>DX</u>	<u>SX</u>	<u>DX</u>	<u>SX</u>
Stance time [msec]	860	910	609 - 651	583 - 668
Swing time [msec]	590	600	410 - 442	406 - 452
Stance time [% stride]	59	60	58 - 61	57 - 61
Swing time [% stride]	41	40	39 - 42	39 - 43
Stride time [msec]	1450	1510	1030 - 1082	1003 - 1107
Cadence [step/min]		81	110 - 118	110 - 118
	<u>Fw Dx</u>	<u>Fw Sx</u>	<u>Fw Dx</u>	<u>Fw Sx</u>
Double supp. time [msec]	140	120	130 - 150	81 - 92
Double supp. [% stride]	10	8	12 - 14	8 - 9



<u>Parametri di distanza</u>	<u>DX</u>	<u>SX</u>	<u>DX</u>	<u>SX</u>
Step length [mm]	483	521	614.87 - 623.87	721.21 - 758.90
Velocity [m/sec]	0.63	0.66	1.27 - 1.39	1.27 - 1.40
Swing velocity [m/sec]	1.56	1.66	3.16 - 3.43	3.09 - 3.46
Stride length [mm]	918	999	1330.43 - 1478.14	1342.45 - 1462.14
Step width [mm]		294	98.48 - 139.22	98.48 - 139.22
Mean velocity [m/sec]		0.65	1.27 - 1.39	1.27 - 1.39



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 From marker.....
 


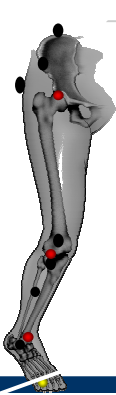
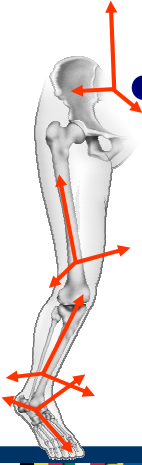
Flexion/estention abdo/adduzione
 esternal internal rotation

2[^] pag of REPORT







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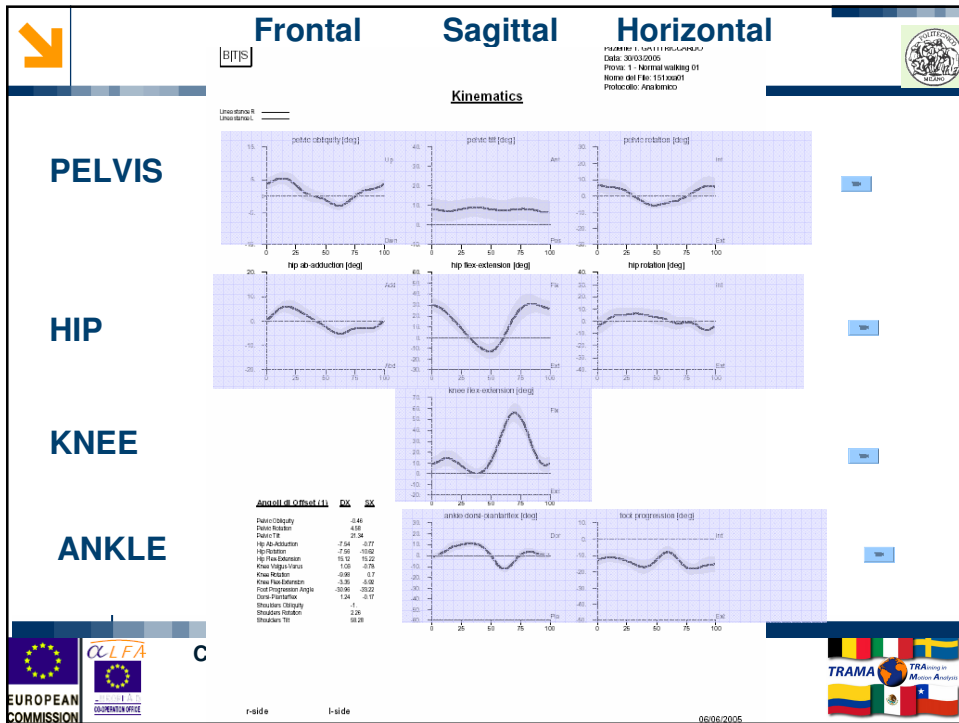
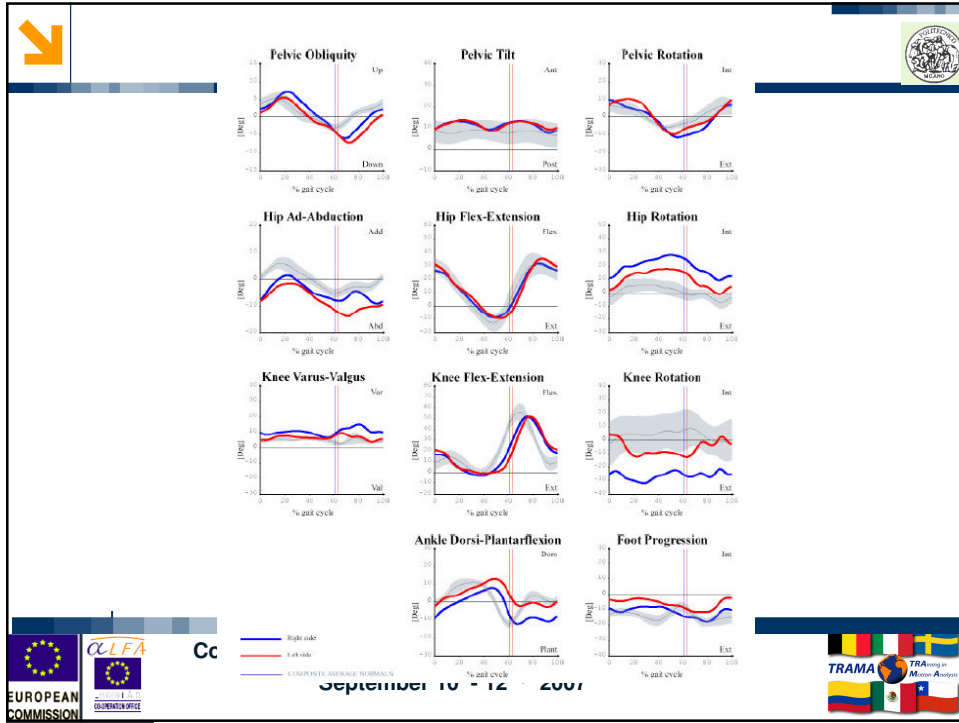





Marker "real" (on the patient)  ●

Marker "Virtual" (Computed with a Mathematical computation)  ●













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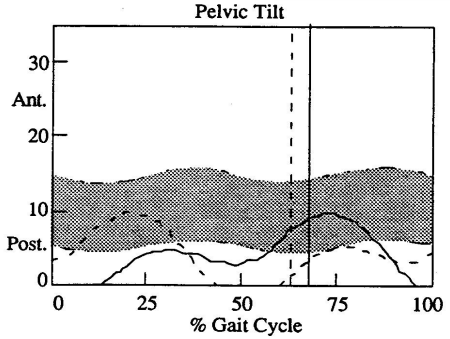



Main alterations







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PELVIS


POSTERIOR TILT



GLUTEUS ,ischiocrurali, LUBAR CIFOSIS



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PELVIS

ANTERIOR PELVIC TILT

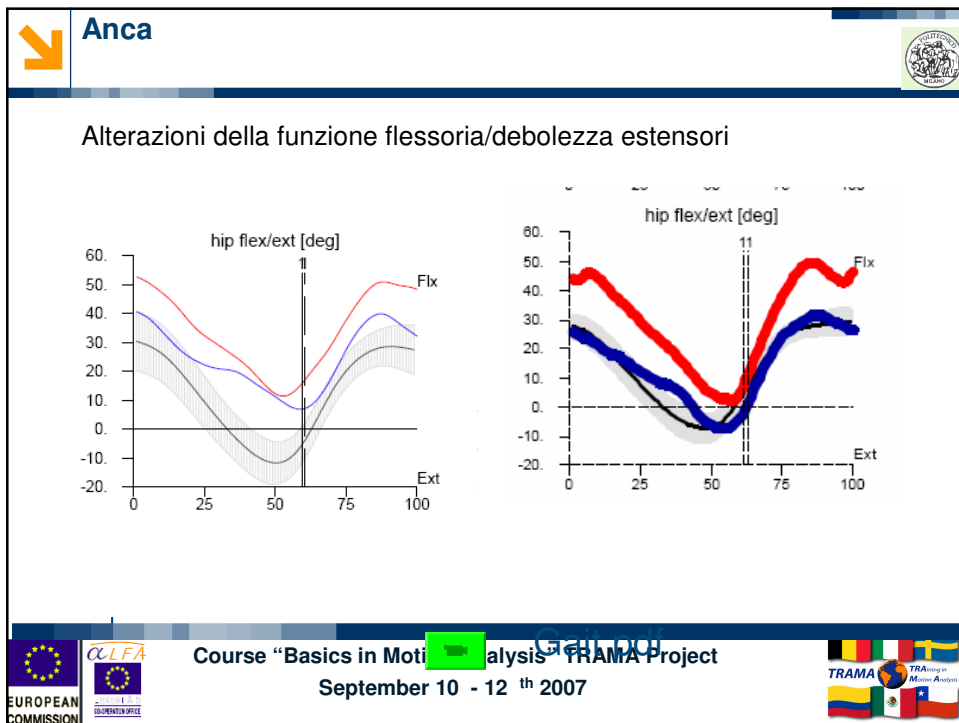
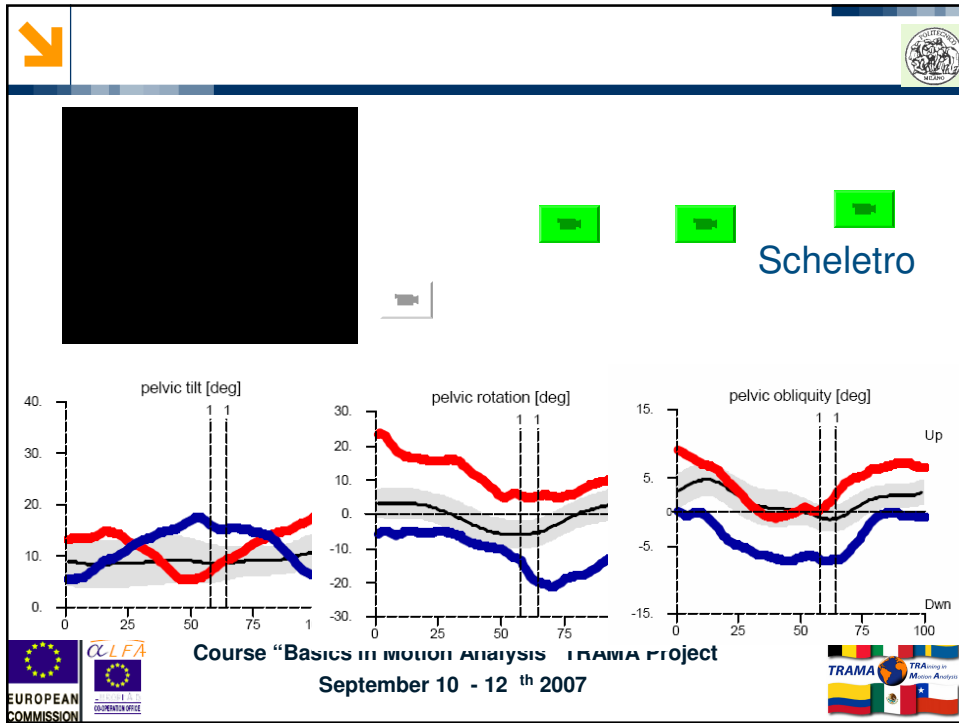
Tension of hip flexors
Weakness of hip extensors
Weakness of abdominals
Deficit in maintaining equilibrium

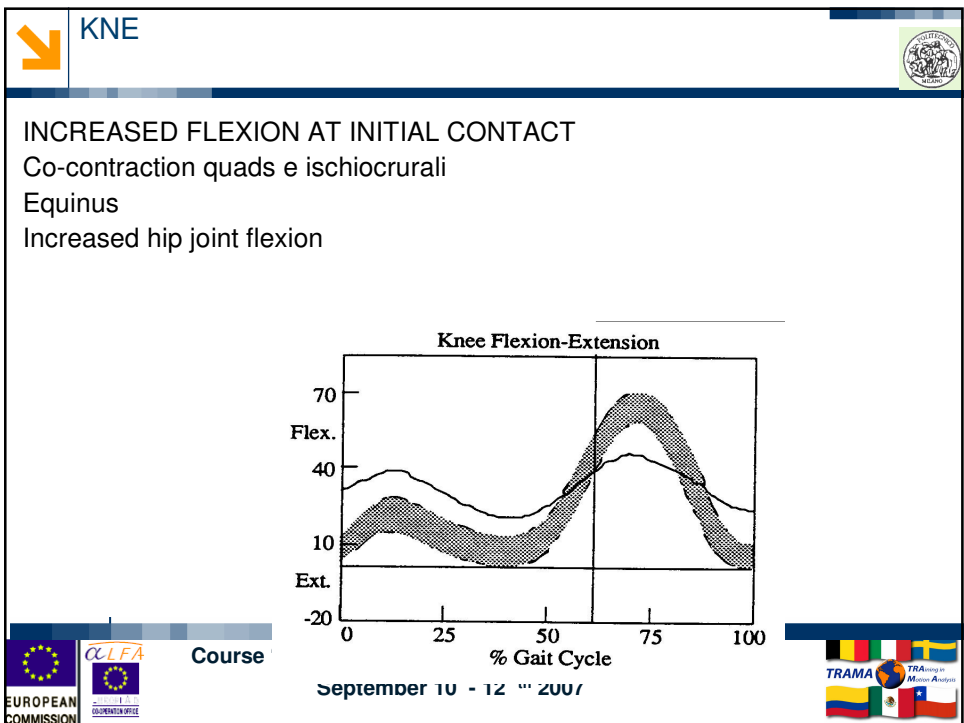
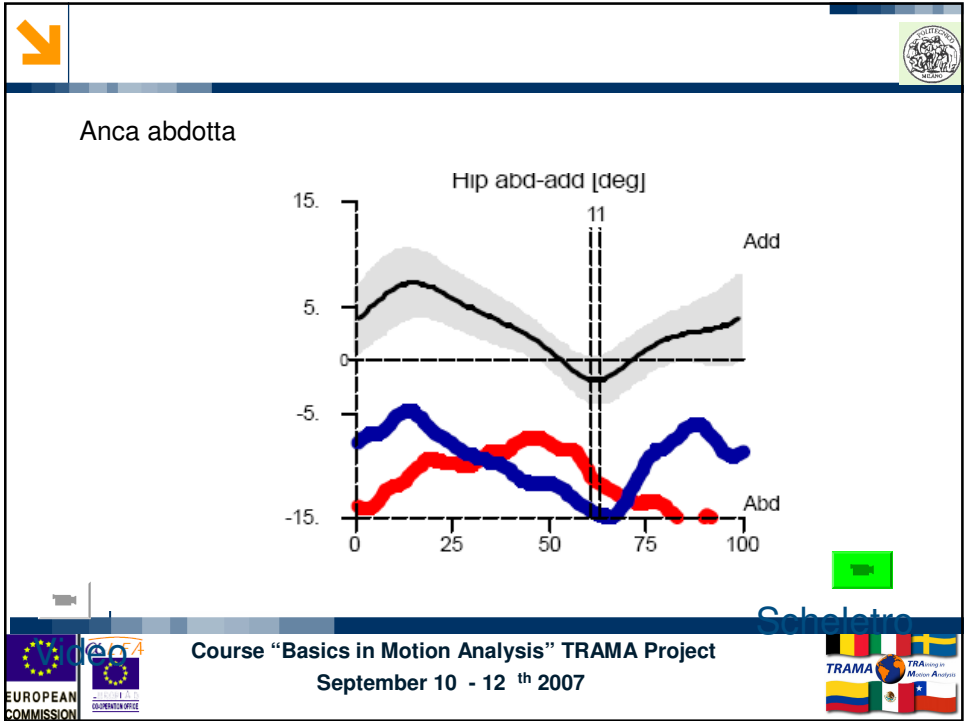
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PELVIS: shape

SINGLE BUMP (EMIPLEGIA)
DOUBLE BUMP (DIPLEGIA)

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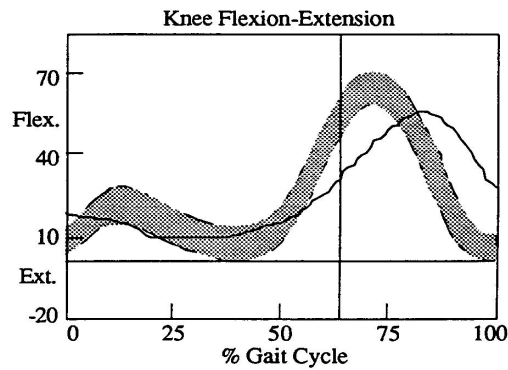




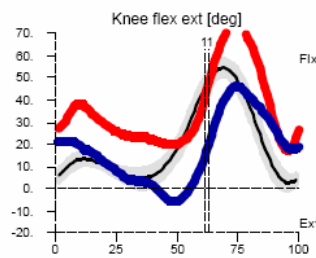
KNEE JOINT



RIDUCED FLEXION IN SWING
Rectus femoris spasticity



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Hemiplegia



Diplegia



Skeleton



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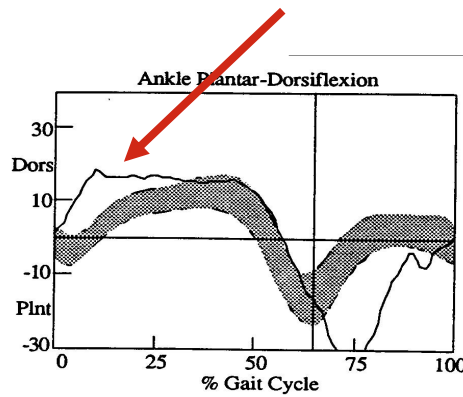
ANKLE JOINT



INCREASED DORSIFLEXION IN STANCE

Triceps weakness

Over lengthening of Achille Tendos



Course "Ba

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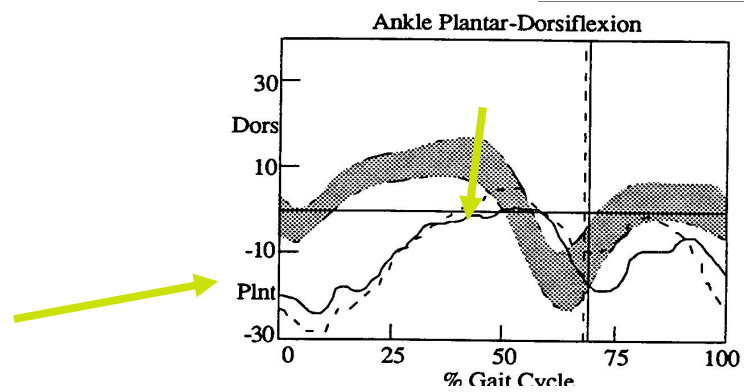


ANKLE JOINT



Reduction of DORSIFLEXION IN STANCE

Triceps spasticity



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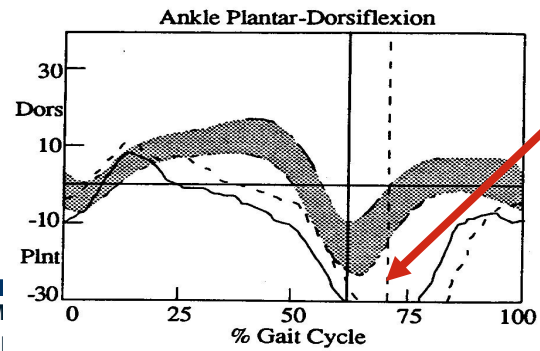
Ankle joint



INCREASED PLANTAR FLEXION IN SWING

Triceps spasticity

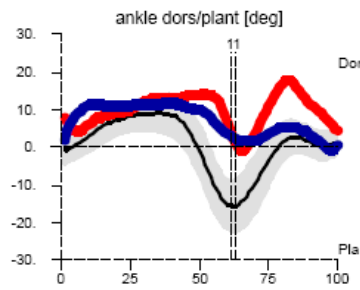
Drop foot



Course "Basics in M
Septeml



Diplegia



Hemiplegia

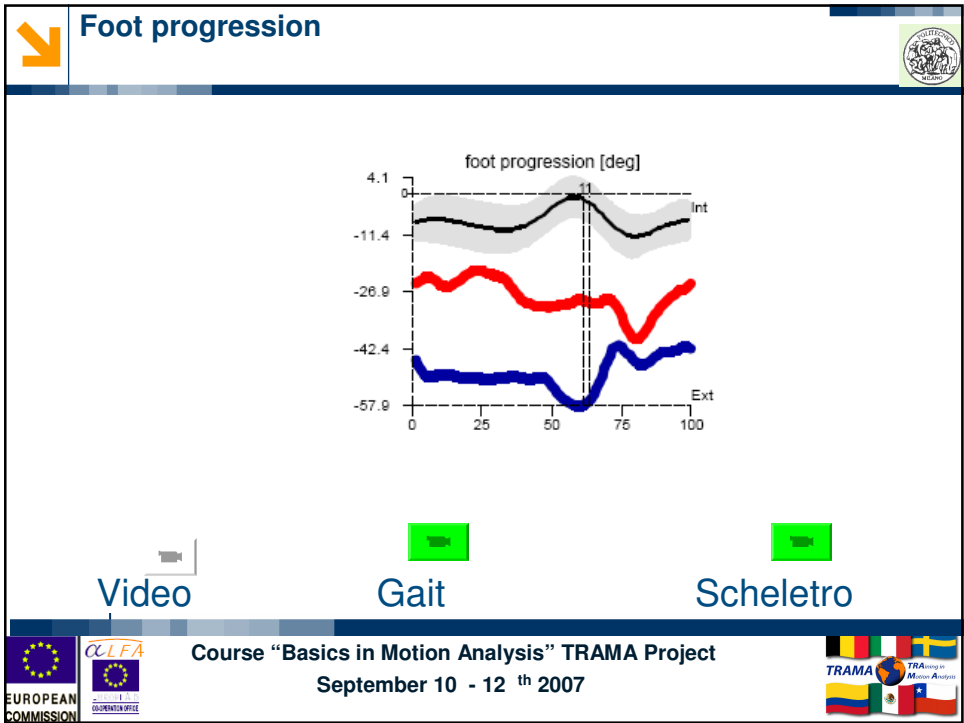
Gait

Scheletro



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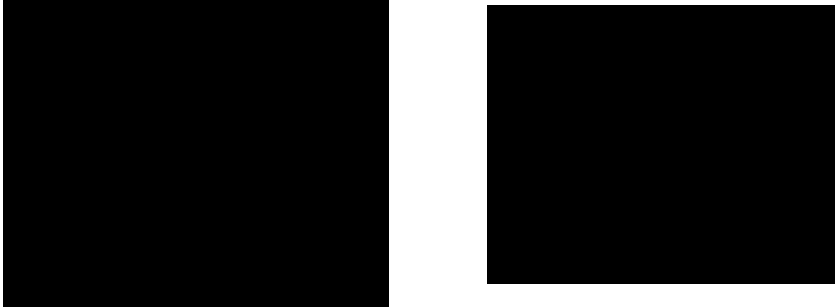
Valutazione dello standing



Offset Angles (1)	RT	LT
Pelvic - Obliquity	-2.05	
Pelvic - Rotation	-10.75	
Pelvic - Tilt	7.09	
Hip - Ab-Adduction	-7.89	0.24
Hip - Rotation	28.98	5.65
Hip - Flex-Extension	9.31	14.02
Knee - Ab-Adduction	14.21	6.87
Knee - Rotation	-47.06	-29.48
Knee - Flex-Extension	14.9	20.88
Foot progression angle	-40.93	-29.56
Dorsi plantarflex	13.46	16.4
Shoulder - Ab-Adduction	8.9	
Shoulder - Rotation	-11.87	
Shoulder - Flex-Extension	18.87	

Gait Scheletro

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↓ Con e senza tutori



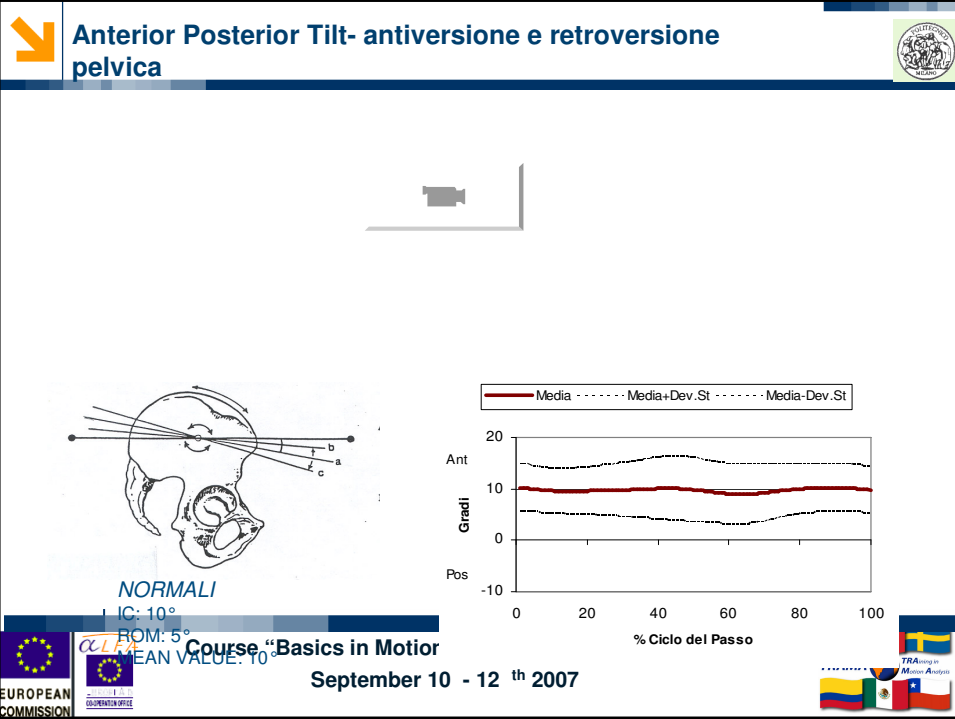
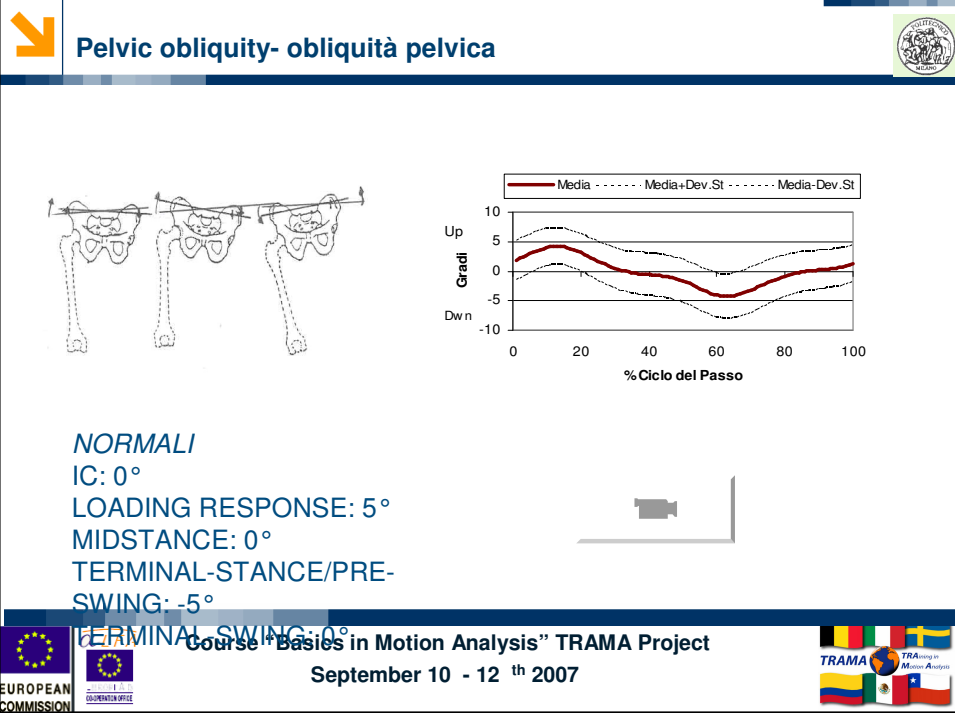
 **WHITOUT** **WHIT** 

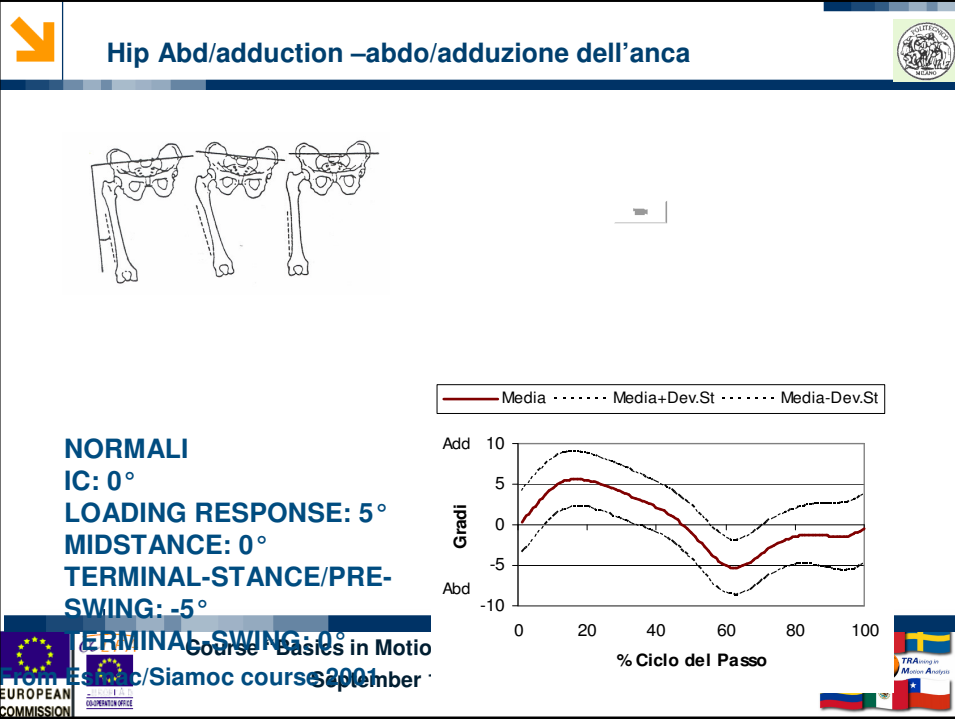
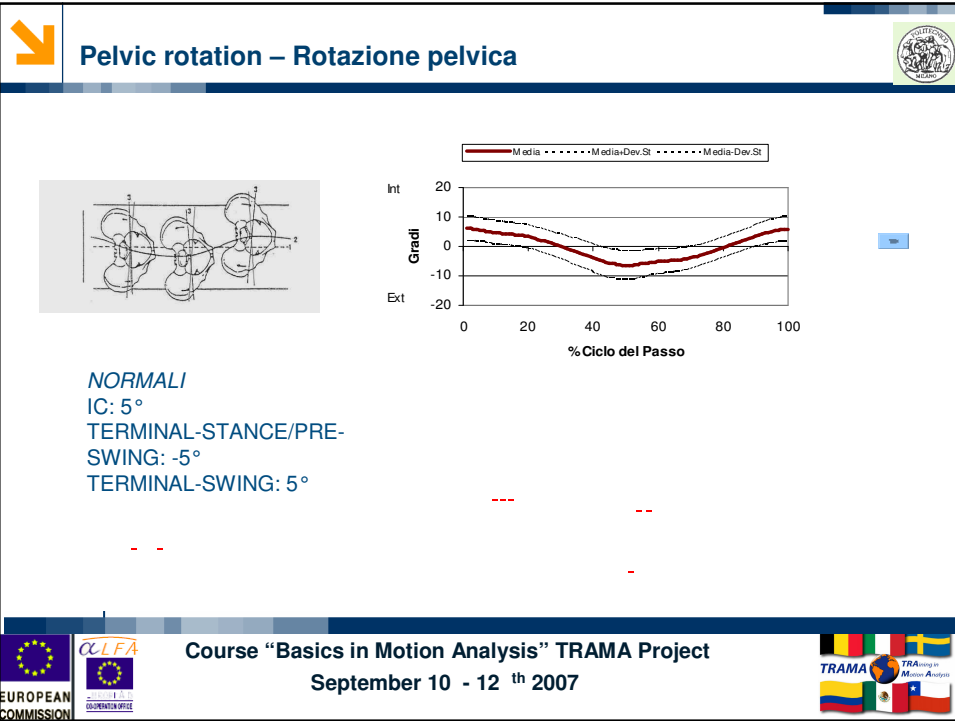
EUROPEAN COMMISSION CCLFA Course "Basics in Motion Analysis" TRAMA Project September 10 - 12th 2007 TRAMA TRAMA in Motion Analysis

↓

Thank you

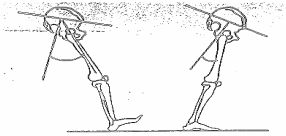
EUROPEAN COMMISSION CCLFA Course "Basics in Motion Analysis" TRAMA Project September 10 - 12th 2007 TRAMA TRAMA in Motion Analysis



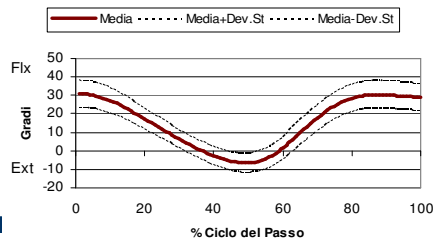




Hip flexion extension- flesso estensione dell'anca



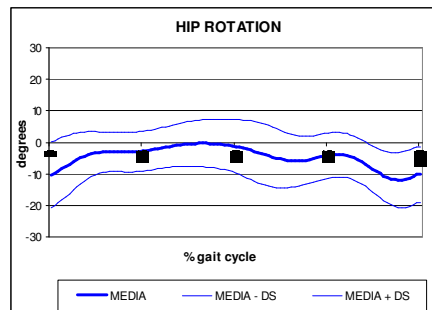
NORMALI
IC: 35°
TERMINAL-STANCE: -5° ;
-10°
TOE-OFF: 0°
MID-SWING/TERMINAL-
SWING: 35°



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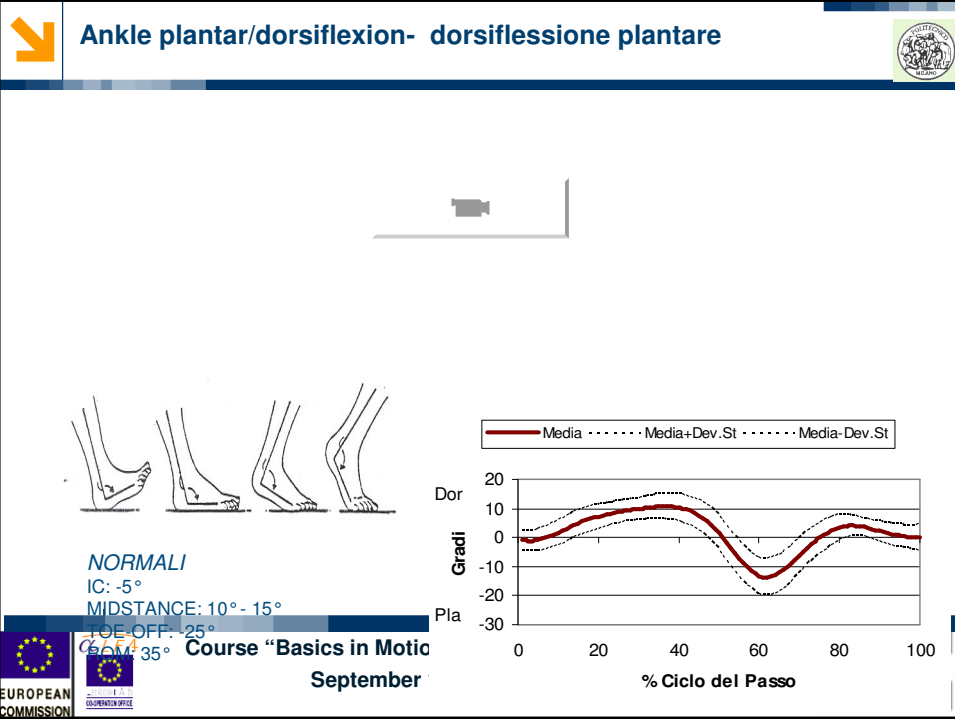
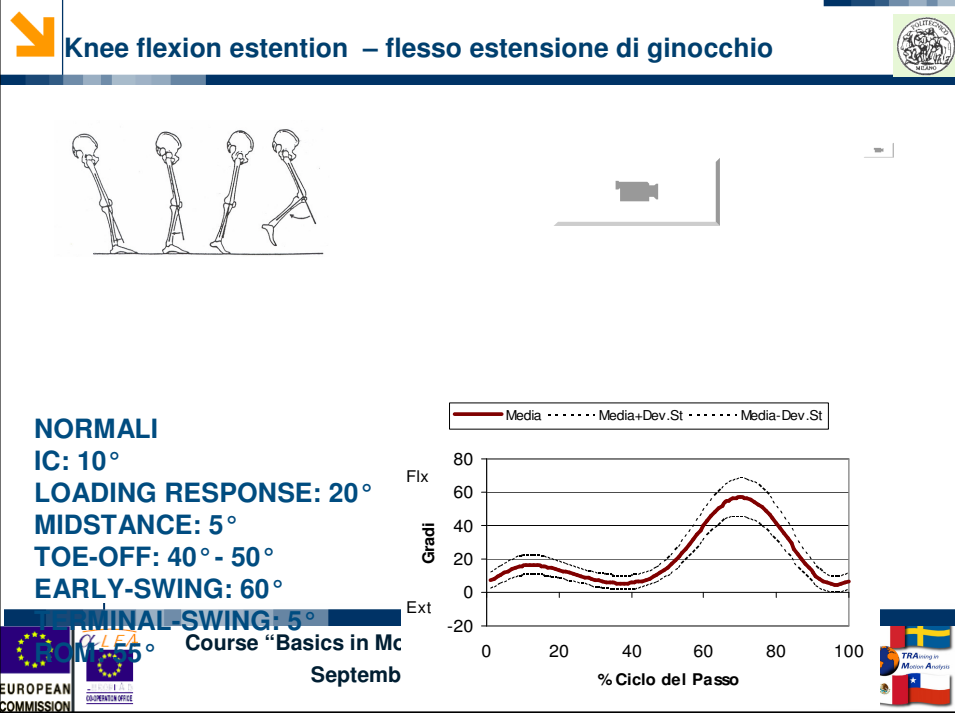


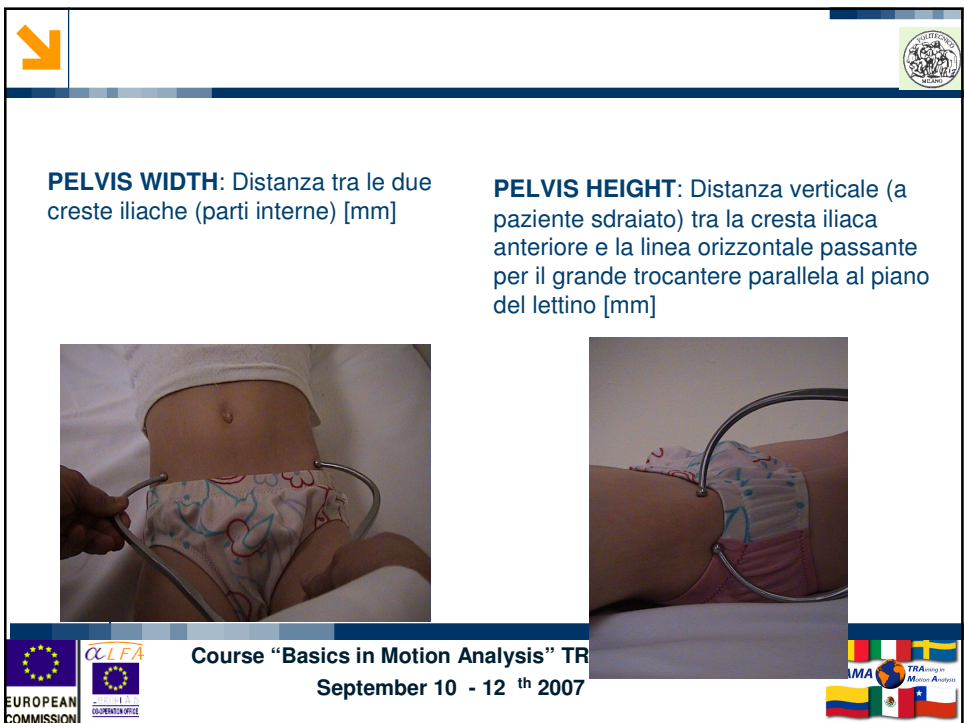
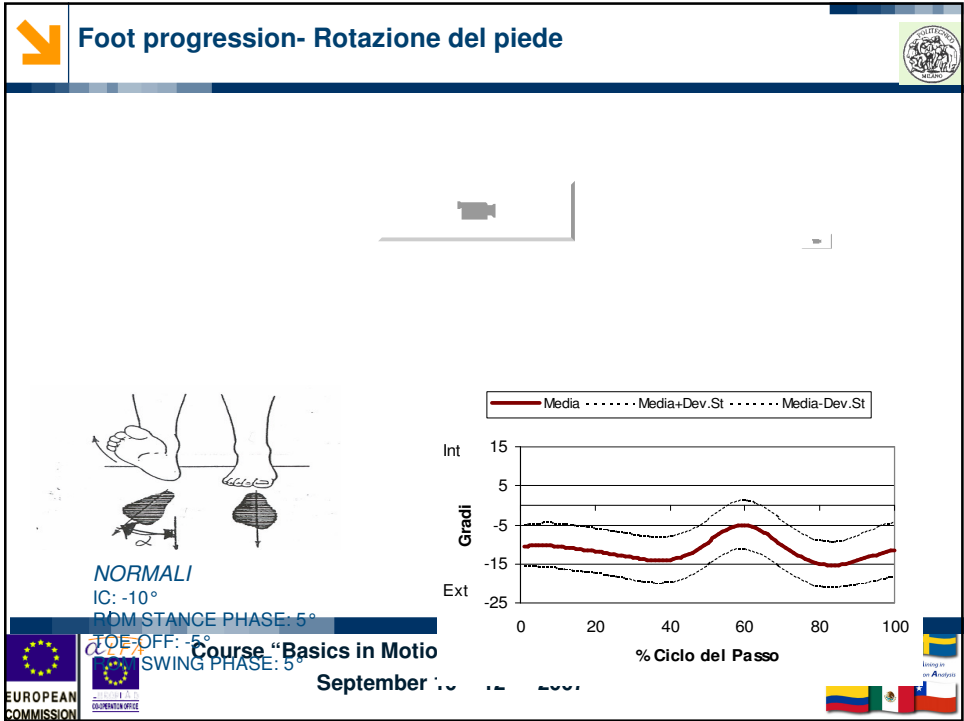
NORMALI
ROM <10°
IC: -10°
LOADING RESPONSE: 0°



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KNEE DIAMETER: Distanza tra i condili femorali [mm]



ANKLE DIAMETER: Distanza tra il malleolo esterno ed il malleolo interno [mm]





LEG LENGTH: Distanza tra le creste iliache anteriori ed il punto intermedio tra il malleolo esterno ed il malleolo interno [mm]








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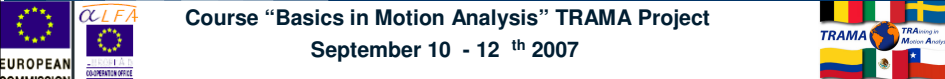
 **Misure antropometriche per protocollo Davis** 

Weight	<input type="text"/>	[kg]
Height	<input type="text"/>	[cm]
Pelvis width	<input type="text"/>	[mm]
	LT	RT
Pelvis Height	<input type="text"/>	<input type="text"/> [mm]
Knee Diameter	<input type="text"/>	<input type="text"/>
Ankle Diameter	<input type="text"/>	<input type="text"/>
Leg Length	<input type="text"/>	<input type="text"/>
Notes	<input type="text"/>	



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Glossario

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Movimenti permessi e convenzioni

- Piano sagittale**

FLESSIONE: avvicinamento di due segmenti adiacenti

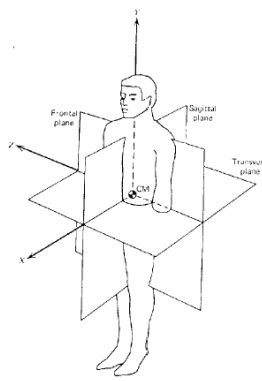
ESTENSIONE: allontanamento di due segmenti adiacenti
- Piano frontale o coronale**

ADDUZIONE: avvicinamento all'asse mediale

ABDUZIONE: allontanamento dall'asse mediale
- Piano orizzontale o trasversale**

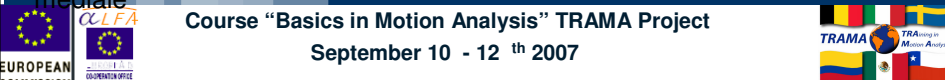
INTRAROTAZIONE: avvicinamento all'asse mediale

EXTRAROTAZIONE: allontanamento dall'asse mediale



mediale

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The diagram illustrates four stages of a leg movement. In the first stage, the leg is extended forward and slightly to the side, with arrow 'a' pointing to the knee and 'b' pointing to the hip. In the second stage, the leg is extended forward, with arrow 'c' pointing to the knee and 'd' pointing to the hip. In the third stage, the leg is extended forward and slightly to the side, with arrow 'e' pointing to the knee. In the fourth stage, the leg is extended forward and slightly to the side, with arrow 'f' pointing to the knee. The label 'sb' is written below the fourth stage.



8) Coscia e anca:
 a) flessione;
 b) estensione;
 c) abduzione;
 d) adduzione;
 e) rotazione interna;
 f) rotazione esterna.

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 TRAMA TRAMA in Motion Analysis

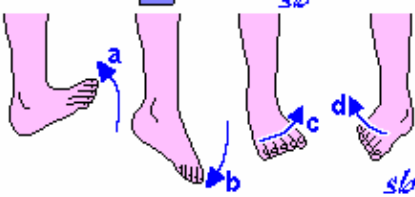
The diagram shows a person standing with one leg extended forward. Arrow 'a' points to the knee, and arrow 'b' points to the hip. The label 'sb' is written below the diagram.





9) Gamba:
 a) flessione;
 b) estensione.



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 TRAMA TRAMA in Motion Analysis

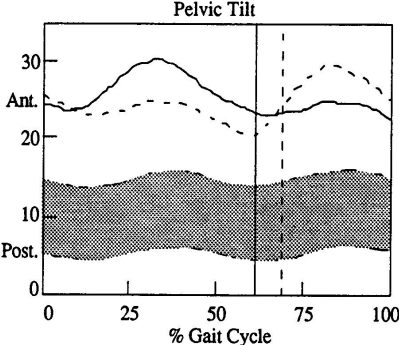
10) Piede:
 a) flessione dorsale o flessione;
 b) flessione plantare o estensione;
 c) rotazione interna o supinazione o inversione;
 d) rotazione esterna o pronazione o eversione.







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PELVI


TILTING PELVICO ANTERIORE
 Tensione flessori anca
 Ipostonia estensori dell'anca
 Ipostonia addominali
 Deficit equilibrio







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INTERVENTO NELLE PARALISI CEREBRALI INFANTILI






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TENSIONE PSOAS

Crouch gait
Generatori di potenza



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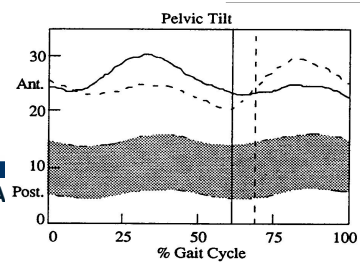


TENSIONE PSOAS



CINEMATICA:

- Anterior pelvic tilt
- Double bump pelvis
- Ridotta estensione d'anca in terminal stance



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TENSIONE PSOAS



CINETICA:

- Pattern estensorio d'anca dominante



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TENSIONE PSOAS



TRATTAMENTO:
Allungamento intramuscolare psoas



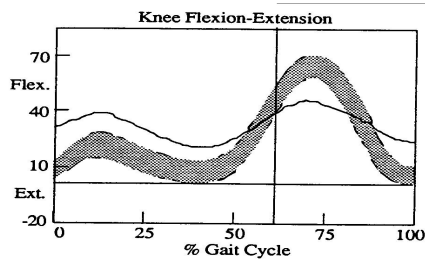
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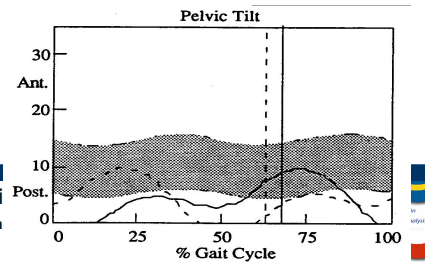
ISCHIOCRURALI



CINEMATICA:
Eccessiva flessione di ginocchio @ IC, MS, TS
Pelvic tilting posteriore
Limitata flessione d'anca in mid & terminal swing



Analysis - 12th





ISCHIOCRURALI



CINETICA:

Costante momento estensorio in stance dovuta a crouch
(GRF cade posteriormente al ginocchio)



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ISCHIOCRURALI



TRATTAMENTO:

Serial casting
Botox
Allungamento ischiocrurali



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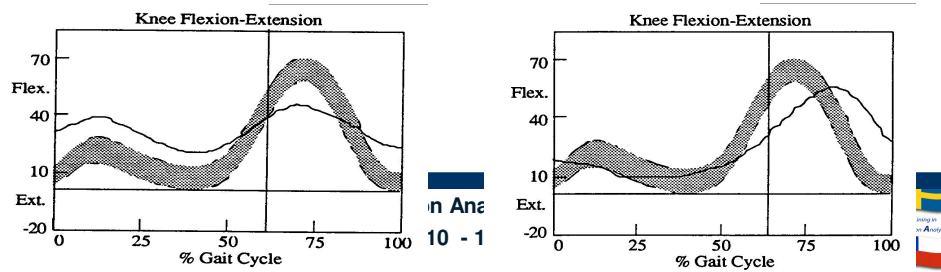


RETTO FEMORALE



CINEMATICA:

Diminuita flessione in swing e/o ritardo nel picco



RETTO



TRATTAMENTO:

Transfer del retto su gracile o sartorio



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GASTROCNEMIO



CINEMATICA

Stance:

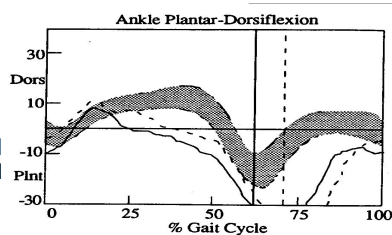
Equino

Limitato 2nd rocker

Anomala PF/KE couple

Swing:

• Drop foot



GASTROCNEMIO



CINETICA:

Anomalo momento precoce

Double bump

Generazione di potenza in MS

Diminuita generazione di potenza al push off

Aumentato momento flessorio al ginocchio



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GASTROCNEMIO



TRATTAMENTO:

AFO

Serial casting

Botox

Allungamento gastrocnemi o achille (Strayer - Hoke)



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