

LES TECHNIQUES D'ANALYSE DE LA MARCHE ET DE L'EQUILIBRE



YES OR NO?

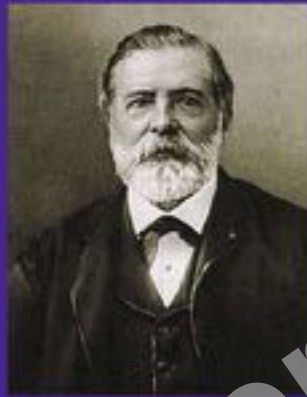
GILBERTE ROBAIN ET PHILIPPE THOUMIE
HOPITAL ROTHSCHILD
PARIS



Analyse clinique de la marche et de l'équilibre

- Marche sur le plat
- Marche en tandem
- Initiation de la marche
- Demi tour
- Marche et escaliers
- Marche et aides techniques
- Equilibre bipodal
- Equilibre unipodal
- Manœuvre de Romberg
- Test de Fukuda
- Functional Reach test
- Timed up and go
- Analyse qualitative
 - Stabilité
 - Symétrie
 - Boiterie
 - Régularité
- Analyse quantitative
 - Vitesse
 - 25 feet walk time
 - 6 minutes test
 - Périmètre de marche

LES INSTRUMENTS DE LA CINEMATIQUE

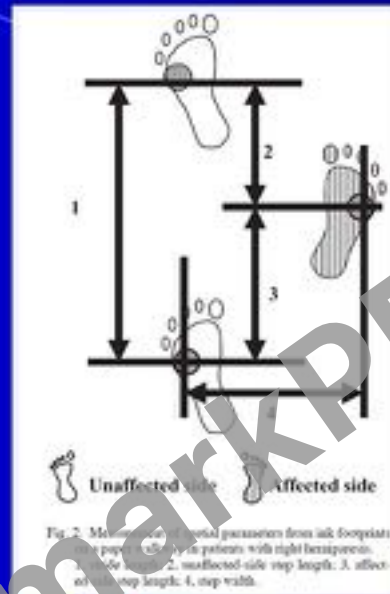


J.E. Marey



EVALUATION CINEMATIQUE

LE SYSTEME GAITRITE



LE LOCOMETRE



GAITRITE - Main - New Install Setup

File Patterns (feet) Options Settings Normal Group About

Kirtley, Chris New Test Test Report

Gender: M Age: 38 Left-Leg: 80 Right-Leg: 80

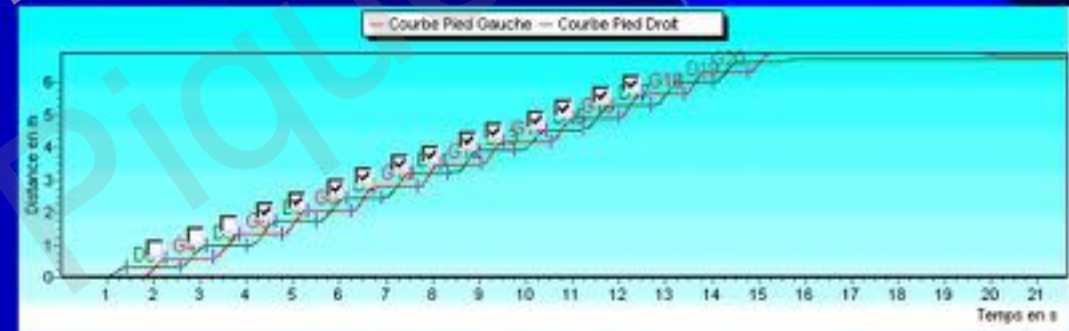
Long Gap 2 (Toe In/Out) Pattern FAP 98

Bilateral Parameters		Left	Right
Step Time [sec]		55	52
Cycle Time [sec]		1.06	1.06
Step Length [cm]		66.04	65.65
Stride Length [cm]		131.73	136.19
H-H Base Support [cm]		10.58	11.59
Single Support [%G]		41.4	41.6
Double Support [%G]		14.0	16.9
Swing [%G]		41.6	41.4
Stance [%G]		58.4	58.6
Step/Extremity Rate		83	82
Toe In / Out (deg)		10	8

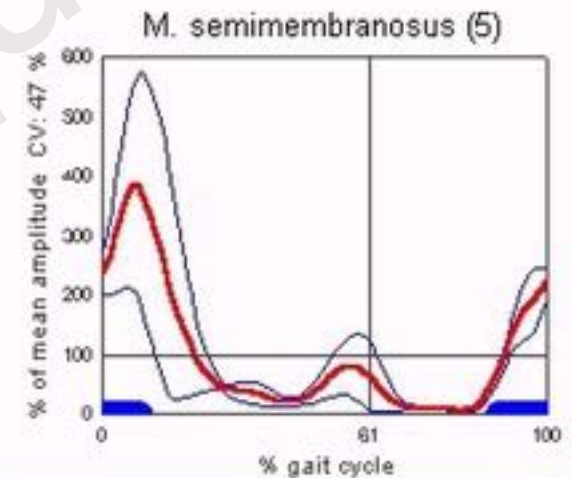
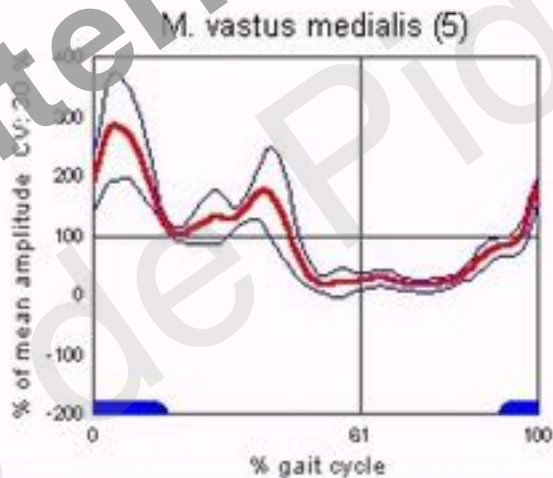
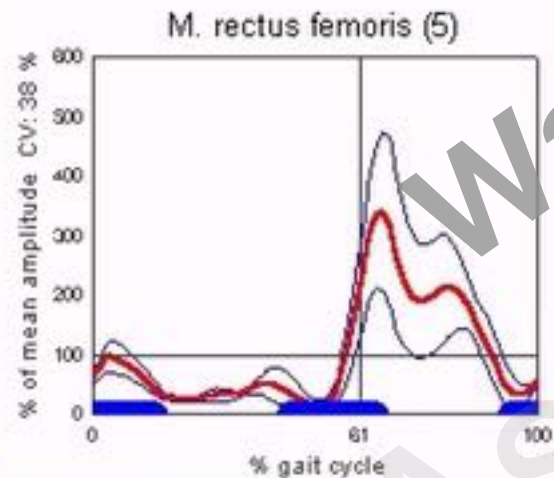
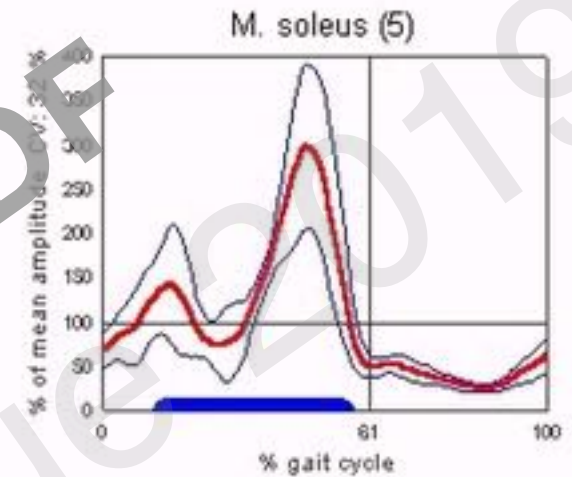
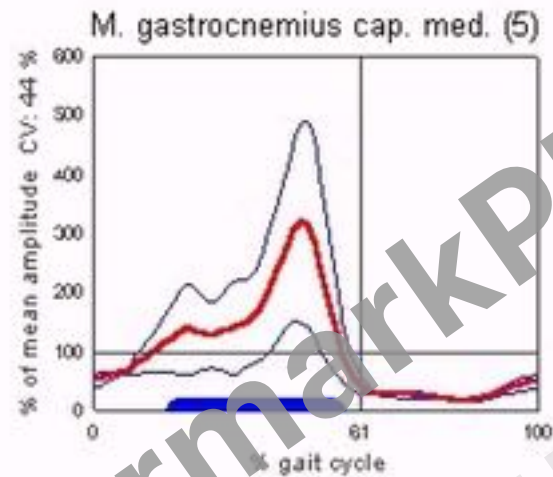
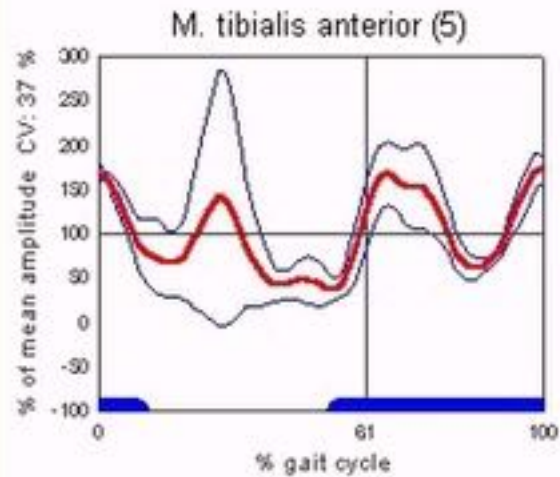
Parameters		Value
Distance [cm]		263.4
Ambulation Time [sec]		2.13
Velocity [cm/sec]		123.7
Mean Normalized Velocity		1.55
Number of Steps		4
Cadence [Steps/Min]		112.7
Step Time Differential [sec]		.63
Step Length Differential [cm]		.39
Cycle Time Differential [sec]		.60

Replay Temporal Detail Cancel Start 2nd Pass Import 2nd Pass Save Memo Exit

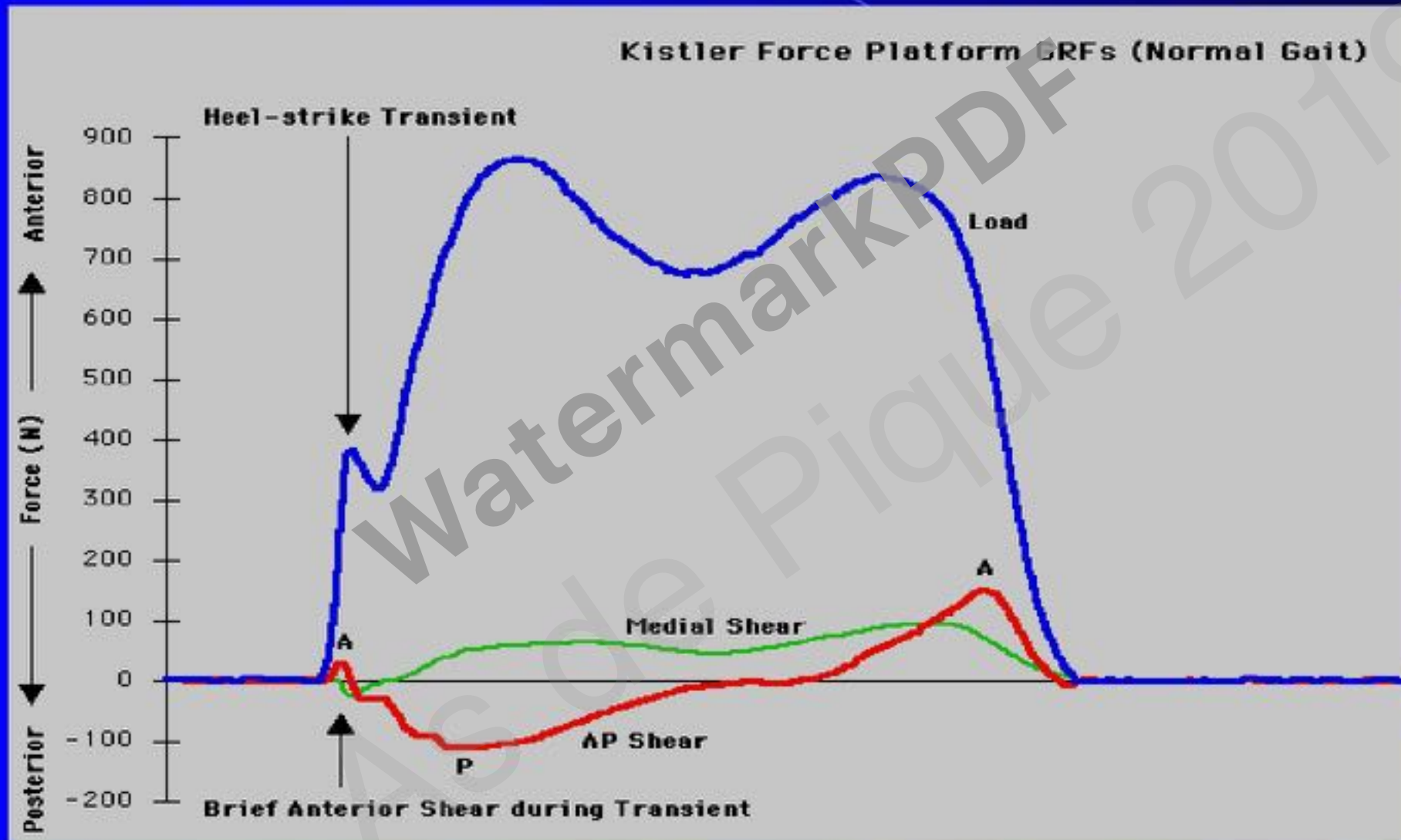
Sample Normal Values



ANALYSE CINESIOLGIQUE

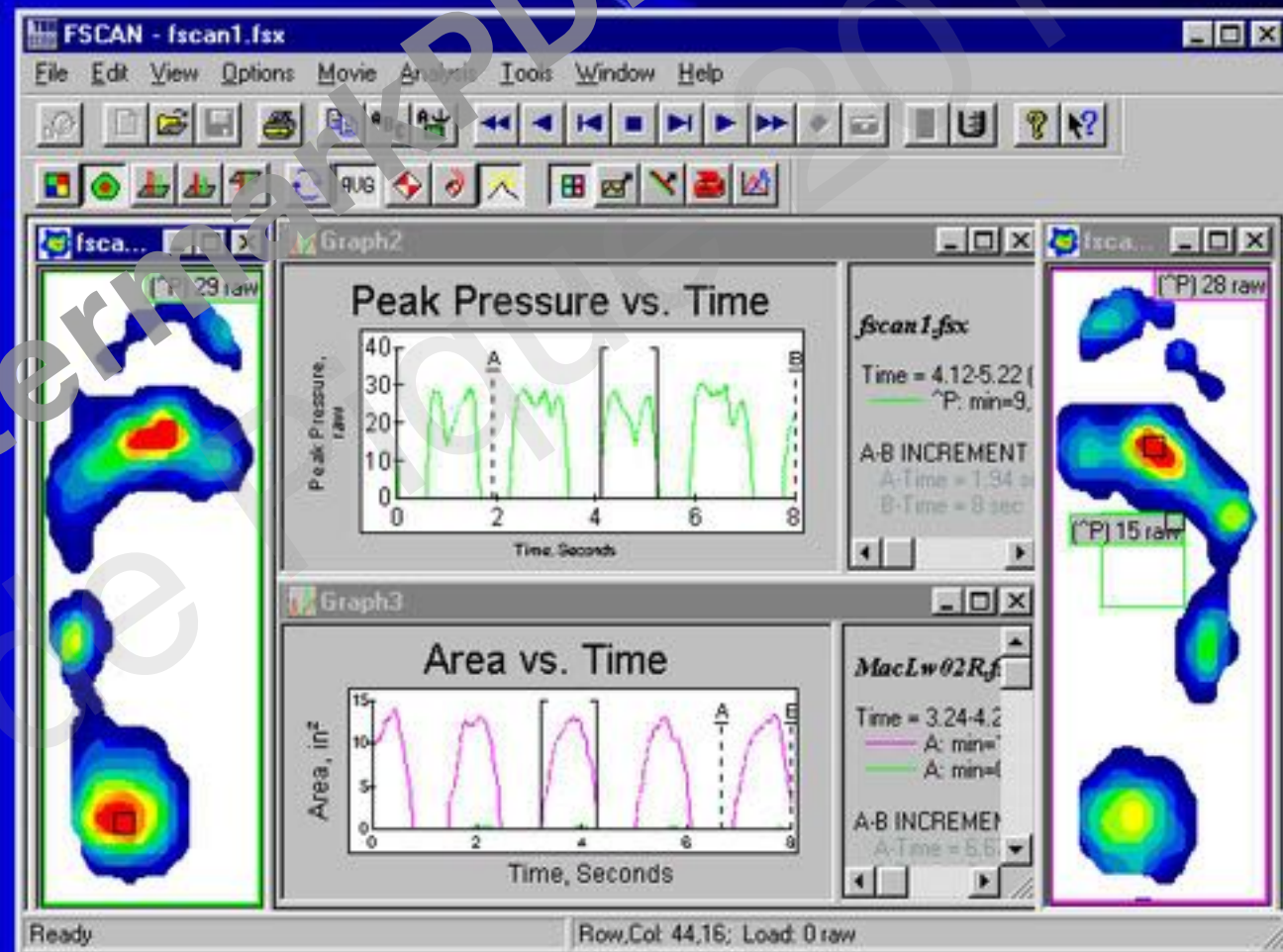
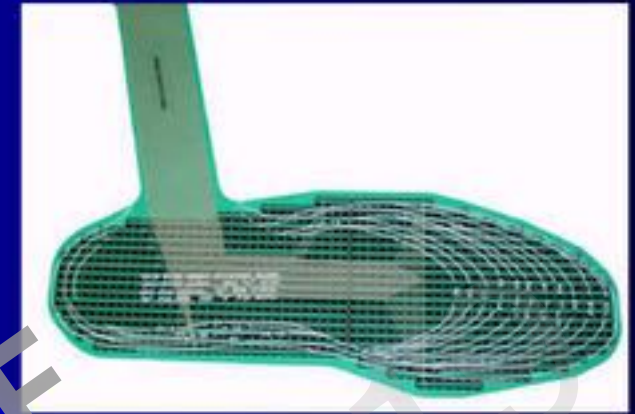


ANALYSE CINETIQUE



EVALUATION CINETIQUE

LES SEMELLES
BAROPODOMETRIQUES



L'ANALYSE DE LA MARCHÉ PAR DISPOSITIFS INTEGRES

- Objectifs: analyse des paramètres de force et puissance au niveau des différents groupes articulaires des articulations portantes
- Principe: Modélisation par cinétique inverse
- Moyens: couplage cinématique et cinétique

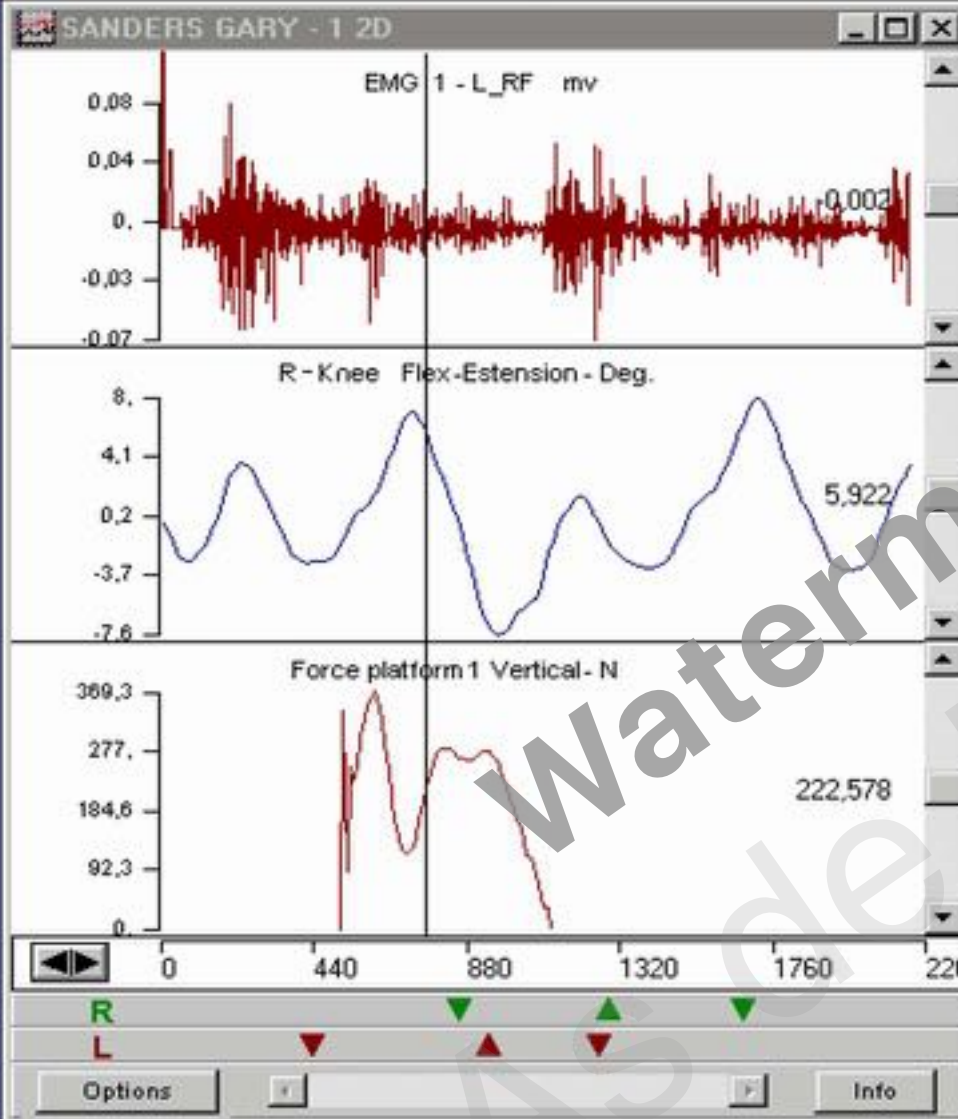
Gait Eliclinic

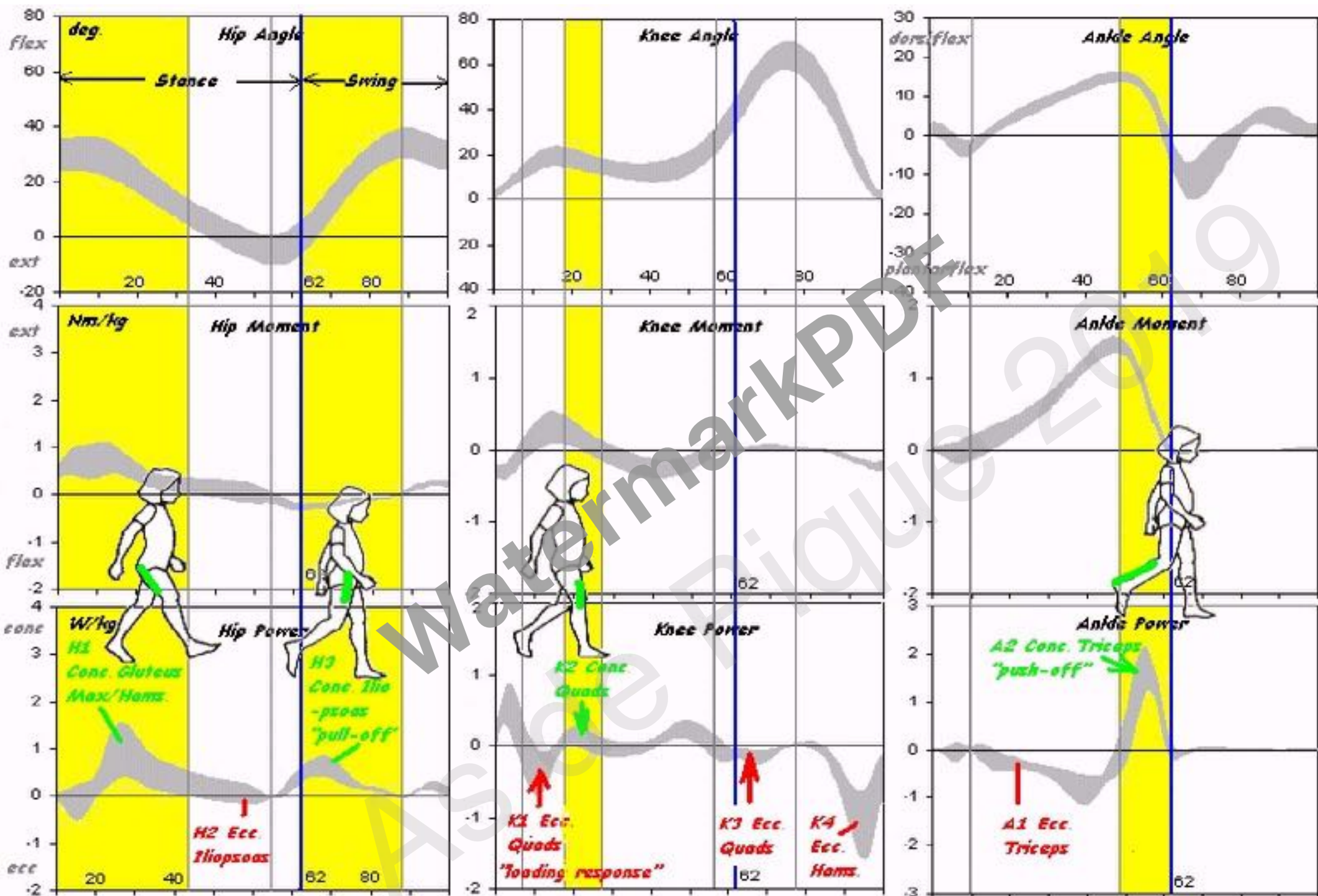
File Analysis Report Tools Window 2



766

Rid-freq: [dropdown]



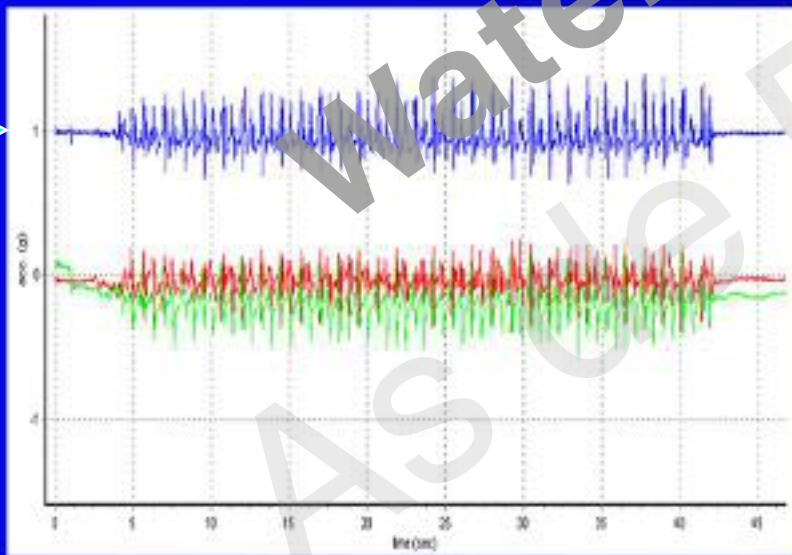
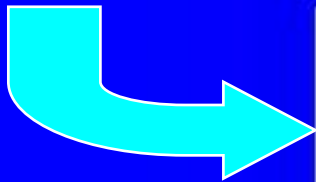
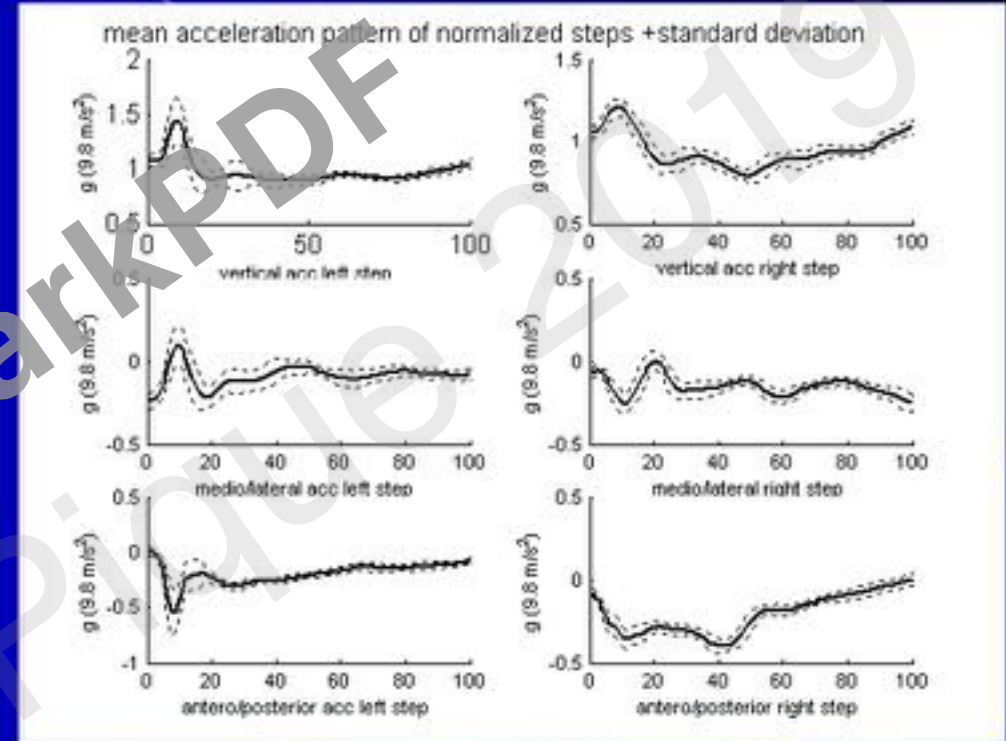


ANALYSE AMBULATOIRE DU MOUVEMENT

● PRINCIPES DE BASE

- MEMOIRE PORTABLE (Data logger)
- CAPTEUR VARIABLE
 - GONIOMETRE
 - EMG
 - ACCELEROMETRE
 - CENTRALE INERTIELLE
- ANALYSE EN TEMPS REEL
- ANALYSE SECONDAIRE SUR PC

ANALYSE PAR ACCELEROMETRE



PERSPECTIVES



Health Subject



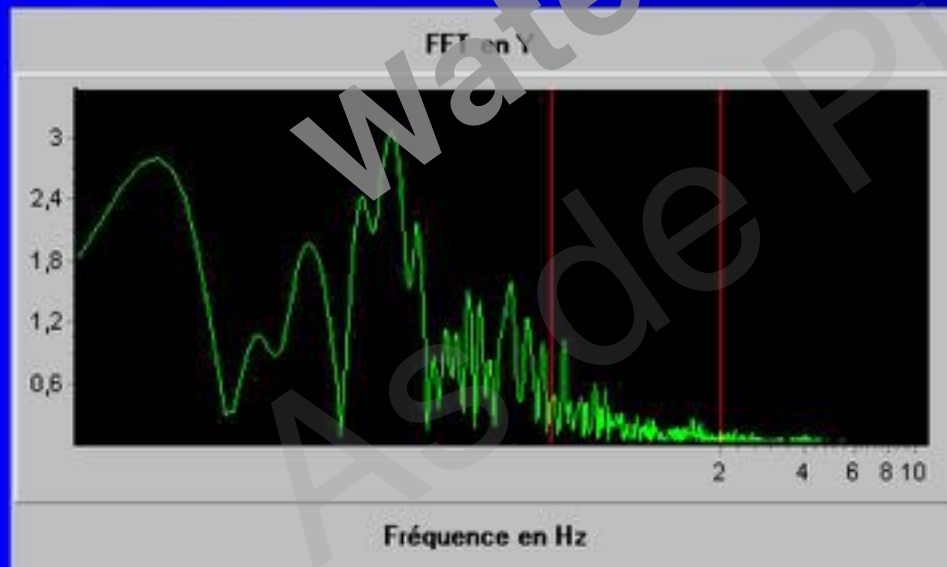
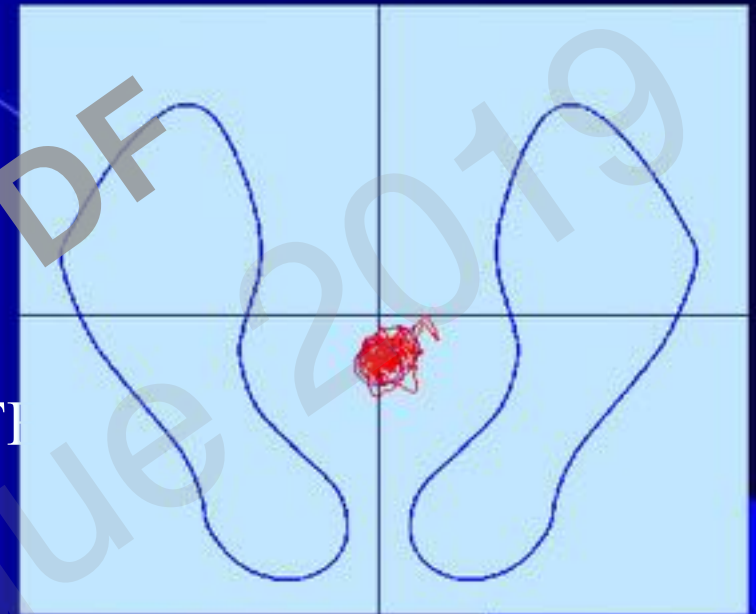
Ataxic Patient

LA STATION DEBOUT

- PARAMETRES DE BASE

- ANALYSE LINEAIRE

- SURFACE 100 mm² (90-200)
- POSITION DU CP : ARRIERE ET DROITE
- FFT: PAS DE PIC FREQUENTIEL



Courseurs :	0,50	Hz	2,00	Hz
Energie	1542,25	183,74	21,19	
%/Energie	88,27	10,52	1,21	
Fréquence (Hz)		Amplitude		
Energie		Energie totale	1747,19	

CONTRIBUTION OF SENSORY INPUTS

VISUAL INPUTS

- EVALUATION OPEN VS CLOSED EYES
- ROMBERG QUOTIENT = $\text{AREA}(YF) / \text{AREA}(YO)$
- MEAN VALUE 2 TO 2,5 DEPENDING OF TARGET DISTANCE

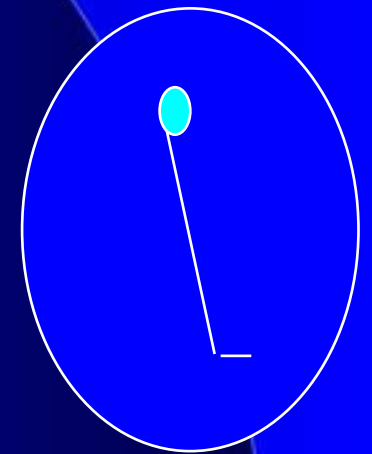
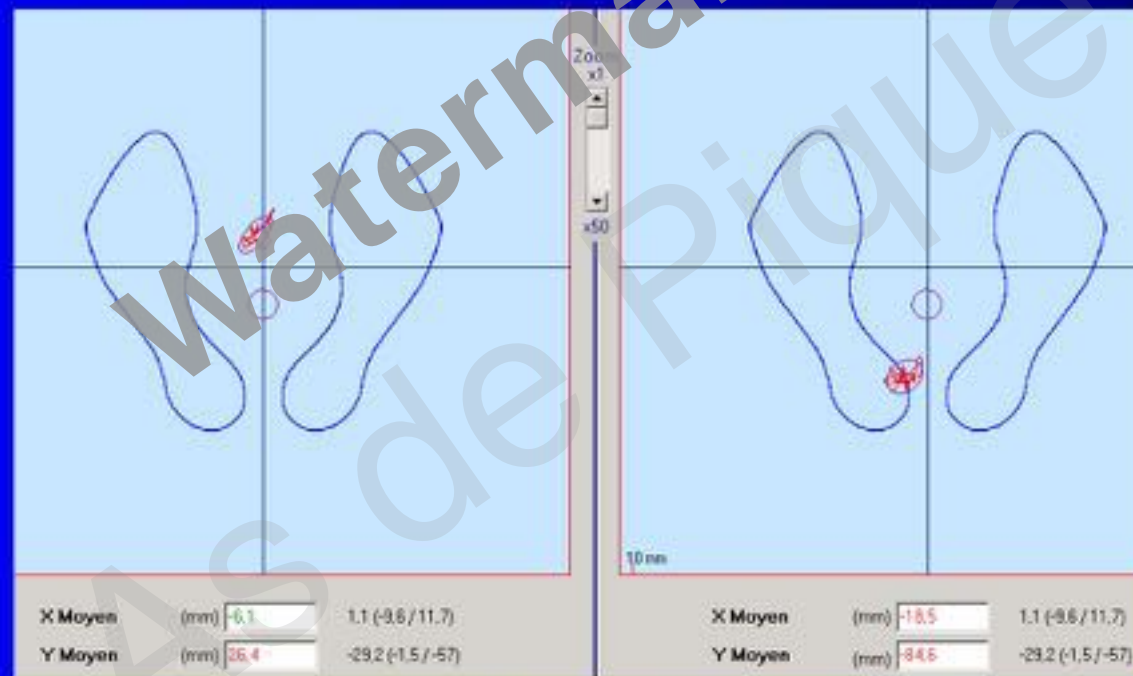
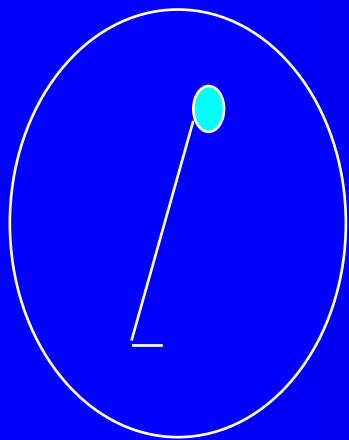
– SOMATOSENSORY INPUTS

- EVALUATION EYES OPEN ON SOLID BASE AND ON FOAM
- SENSORY QUOTIENT = $\text{AREA}(\text{FOAM}) / \text{AREA}(\text{SOLID})$

LIMITS OF STABILITY IN SAGITTAL PLANE

● M SCHIEPPATI

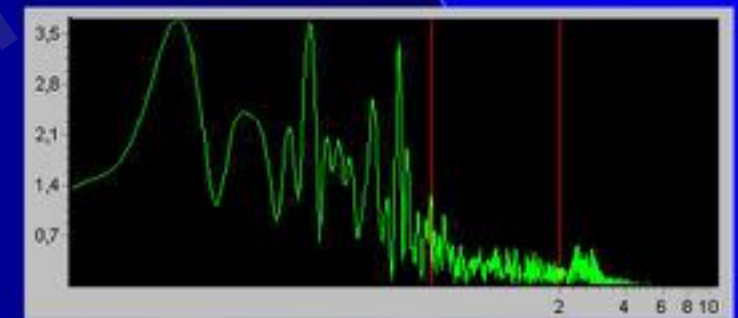
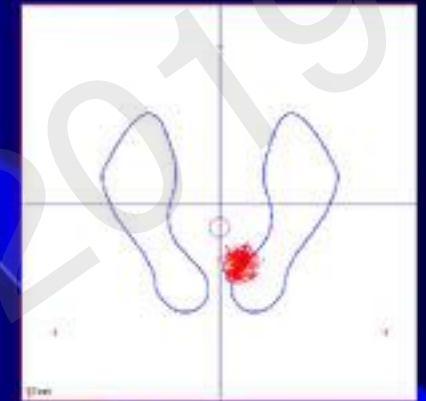
- CHANGES IN CP POSITION IN THREE CONDITIONS
 - (Rest, Forward and Backward pending)
- USEFULL FOR AGING AND PARKINSON DISEASE



APPLICATION A LA STATION DEBOUT IMMOBILE ANORMALE

- PATHOLOGIE
NEUROLOGIQUE

- POSITION
- SURFACE ET
DEPLACEMENTS
- COEFFICIENTS VISUELS ET
PLANTAIRES
- ANALYSE SPECTRALE



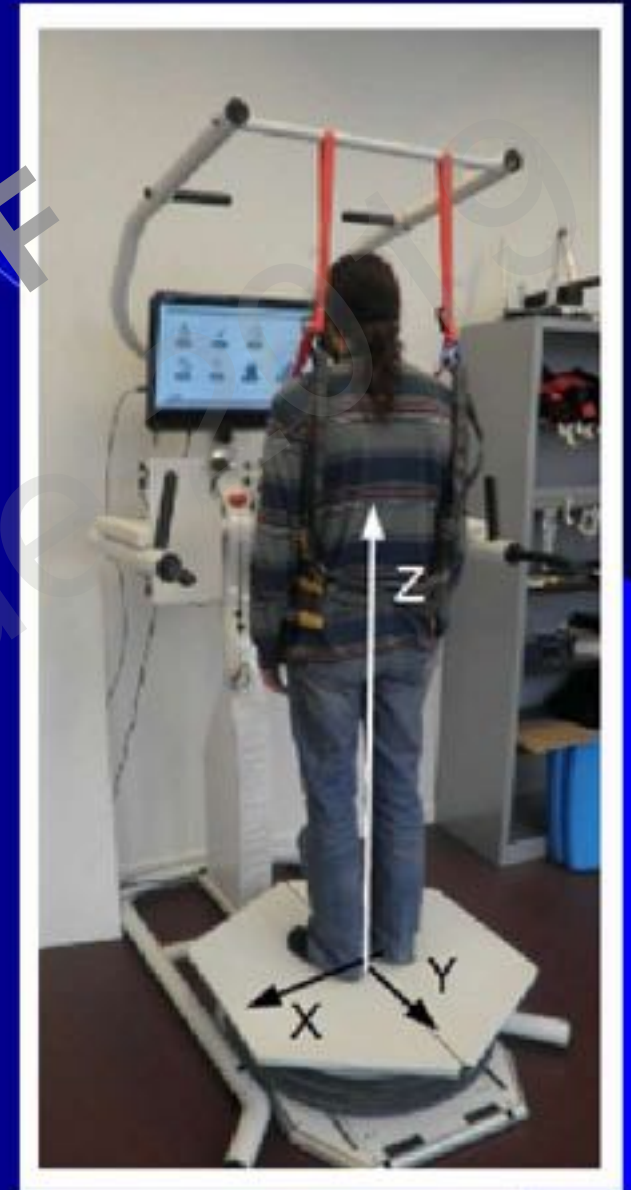
EQUITEST



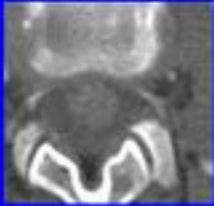
SENSORY ORGANISATION TEST

PERSPECTIVES

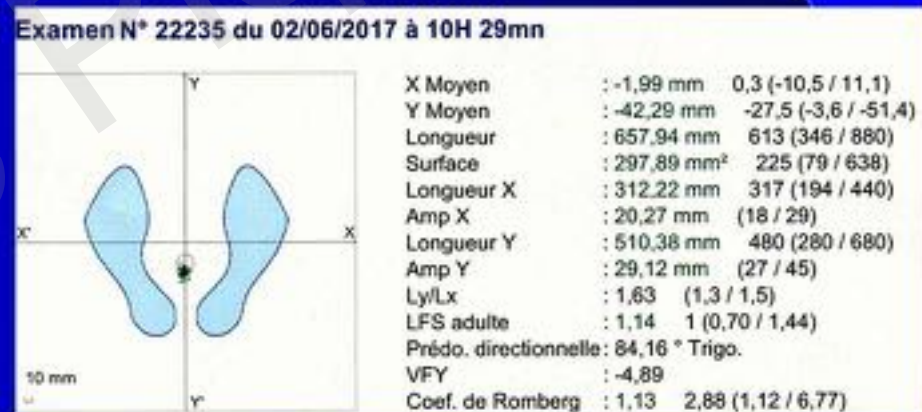
Equilibre dynamique
Equilibre tridimensionnel
Translation
Rotation
Mouvement sinusoidaux



INTERET DE L EVALUATION G ROBAIN



- Patiente présentant un neurinome L3 découvert devant une lombalgie
- Examen clinique normal



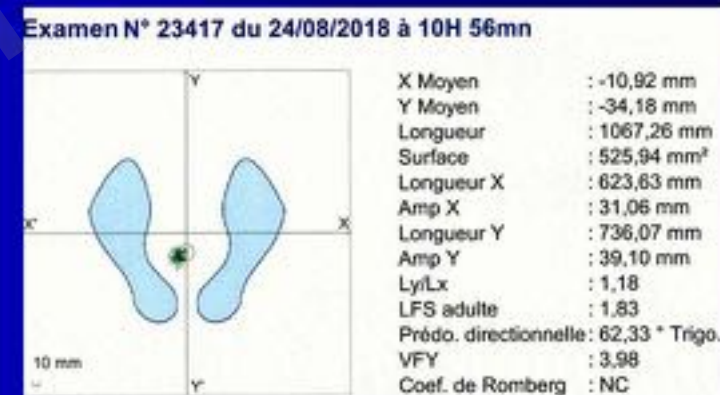
Mousse

YO

YF

Un an après

- Augmentation radiologique de la taille de la lésion
- Paresthésies fluctuantes des membres inférieurs
- Sensibilité normale y compris au diapason



YO

YF

Mousse

Contexte médico légal

- Accident vasculaire cérébelleux après coronarographie
- Persistance de troubles de l'équilibre, de fatigue, TVS
- Berg 52/56
- Time Up and Go 13s
- Vitesse de marche 3,5km/h



WatermarkPDF
As de Pique 2019

LIMITES DE L EVALUATION P THOUMIE

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As de Pique 2019

ATAXIC NEUROPATHIES

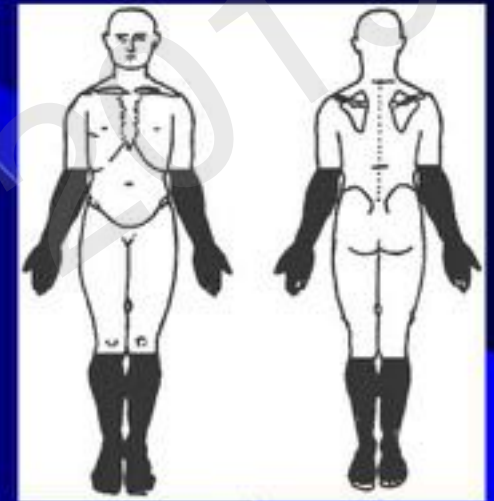
- Uncommon Neuropathies with variable origin

- Chronic inflammatory neuropathies
- Polyneuropathies with dysglobulinemia IgM, IgA
- Medicated polyneuropathies

- Clinical features can affect 4 limbs

- Limited motor impairment
- Ataxia overall main symptom

- Equilibrium
- Prehension



Clinical evaluation of balance

- Romberg test
- Timed Up-and-Go test :TUG
(NV < 8 s)
- Functional Reach Test : FRT
(NV > 25 cm)
- Berg Balance Scale : BBS
(NV : 56/56)

Task

Sit to stand

Stand unsupported for 120 seconds

Sit unsupported for 120 seconds

Stand to sit

Transfers

Stand with eyes closed for 10 seconds

Stand with feet together for 60 seconds

Reach forward with an outstretched arm

Retrieve object from the ground

Turn to look behind

Turn 360 degrees

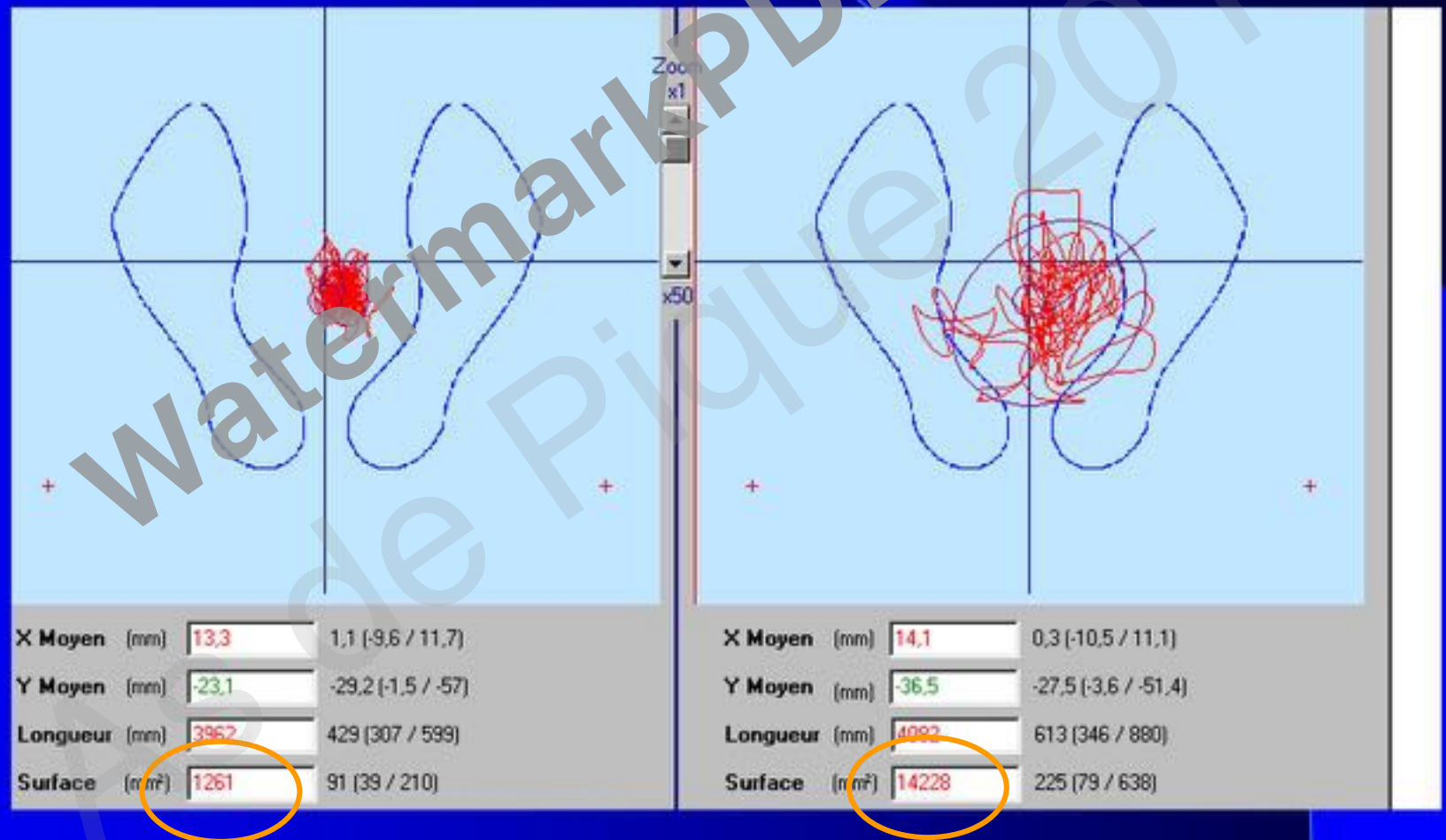
Place alternate foot on stool

Stand with one foot in front of the other for 30 seconds

Stand on one foot for 10 seconds

Example of a patient with polyneuropathy

- Increased sway area eyes open (x6) and closed (x24)



MISSAOUI B and THOUMIE P

Balance training in ataxic neuropathies.

Effects on balance and gait parameters.

Gait Posture. 2013 Jul;38(3):471-6



● POPULATION:

- 30 Neuropathies ataxiantes (15 Romberg +)
- 18F/12H 66 ans (36-85)
- Etiologies
 - PRNIC: 9
 - Dysglobulinémie: 7
 - Idiopathique: 7
 - Divers: 7
- Groupe contrôle
 - 15 sujets sains
 - 9F/6H
 - 66 ans (51-81)

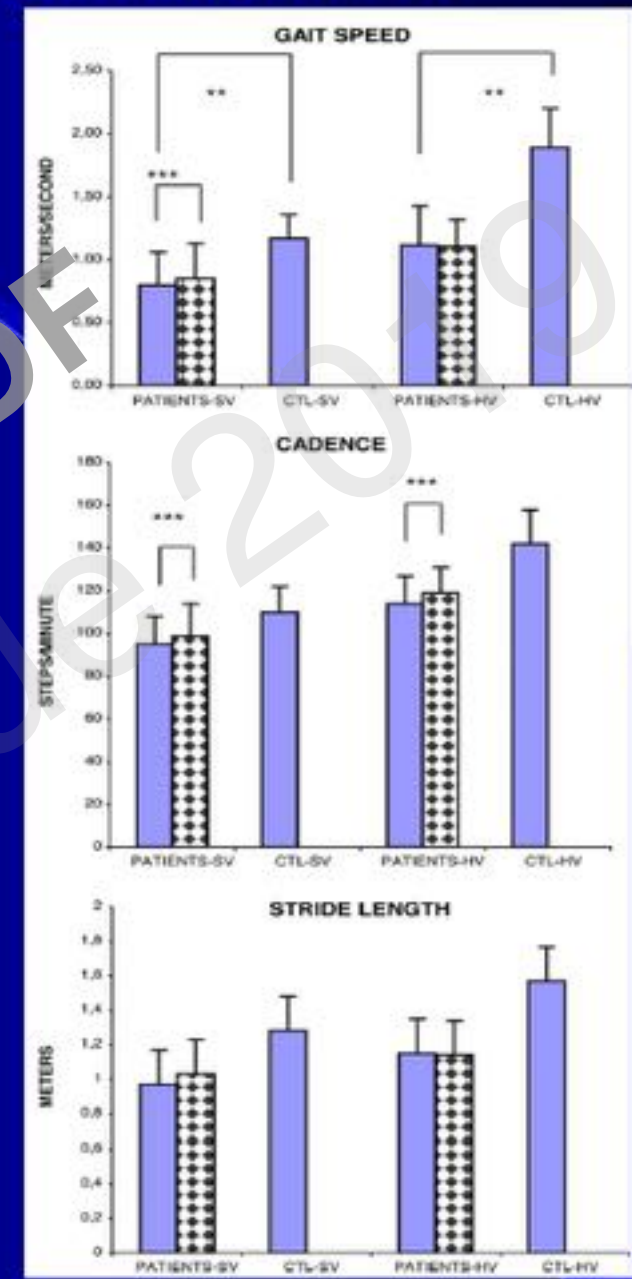
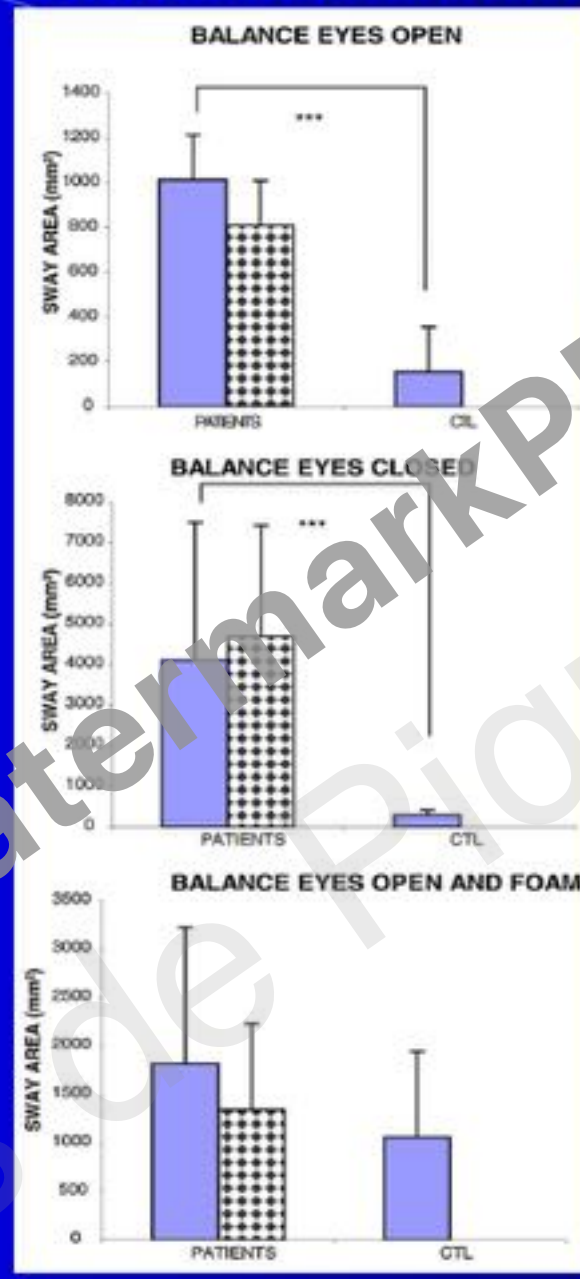
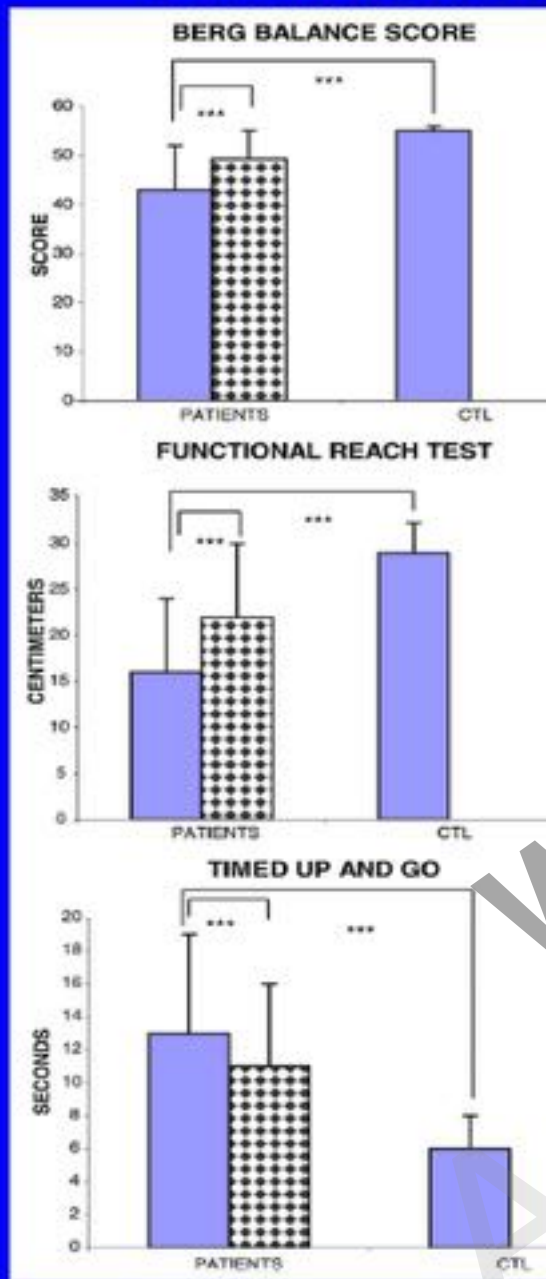
● EVALUATION CLINIQUE

- BERG: 45 ± 9 (n = 56)
- FRT: 18.6 ± 9.5 (n > 25)
- TUG: 12 ± 5 (n < 10)

● EVALUATION INSTRUMENTALE

- Plateforme de forces
- YO YF Mousse
- Analyse non linéaire

SYNTHESE DES RESULTATS APRES REEDUCATION



SYNTHESE



- Priorité à l'évaluation clinique
- Analyse instrumentale réduite à un paradigme donnée:
 - Marche stabilisée
 - Appui bipodal
- Valeur prédictive?
- Reproductibilité?
 - Pas de microsémiologie!!!
- Intérêt de l'évaluation des situations complexes
 - Polypathologies
 - Atteintes sensorielles multiples (SEP)
 - Chirurgie multisite de la paralysie cérébrale chez l'enfant
- Aide à l'apprentissage de la sémiologie