Evaluation clinique de la posture et des troubles d'équilibre: intérêts et limites des principales évaluations

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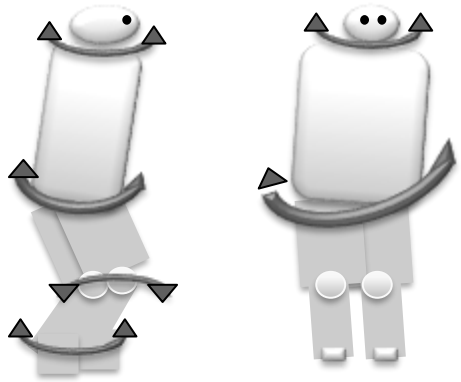
Evaluation clinique
de la posture et des troubles d'équilibre

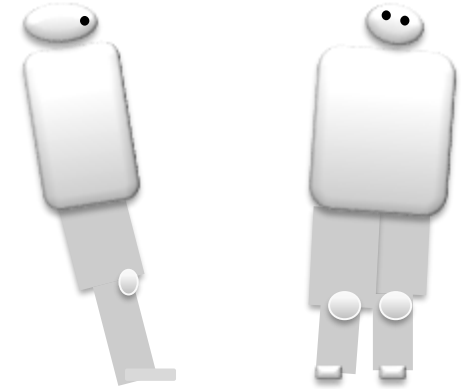
Raisonner simplement
En lien avec la physiopathologie ?

Stabilisation



Pich plane **Roll plane**

Orientation



Pich plane **Roll plane**

retropulsion lateropulsion

Evaluation des troubles de l'équilibre : le point de vue du clinicien

Savoir évaluer

Examen qualitatif + Echelles + Instrumentation

Utilisation pertinente

Outil validé

Evaluer pour comprendre

Comportement observé : effets lésion vs compensation

Evaluer pour prédire

Evaluer pour guider et suivre le traitement

Prévenir la chute

Guider la restauration posturale, les prescriptions de compensation

aides techniques

Propriétés d'un outil d'évaluation

www.cosmin.nl

Population cible bien définie : outil catégoriel ou générique

Objectif d'évaluation défini

Content validity - validité de contenu pour les échelles

From perspective of patients + professionnels

Structural validity – validité de structure

Analyses complexes par ex rash analysis sur plusieurs centaines de patients

Internal consistency – consistence interne

alpha de Cronbach- monodimensionalité

Cross-cultural validity

Reliability (ICC, kappa coef)) and **measurement error** (SDC)

Criterion validity

Responsivness (sensibilité au changement)

Avantage des échelles ordinales ?

Avantage de l’évaluation instrumentale ?

Avantages des échelles ordinales ?

Faisabilité - coût

Avantages de l'évaluation instrumentale ?

Compréhension mécanismes en cause

Sensibilité au changement

→ **Doivent être associées +++**

Kit de l'évaluation des troubles de l'équilibre en MPR neuro

Examen clinique qualitatif

Echelles cliniques ordinales

Evaluation chronométrique

Verticale subjective

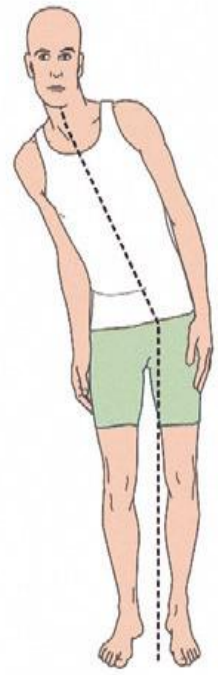
Posturographie

Autres outils d'évaluation

Inpection: orientation verticale

Whole body upright

Head and trunk tilts



Trunk tilt

Head tilt

Whole body tilt

Most frequent clinical pictures in the frontal plane

Outils génériques d'évaluation de l'équilibre

Evaluation chronométrées

de temps de maintien de posture

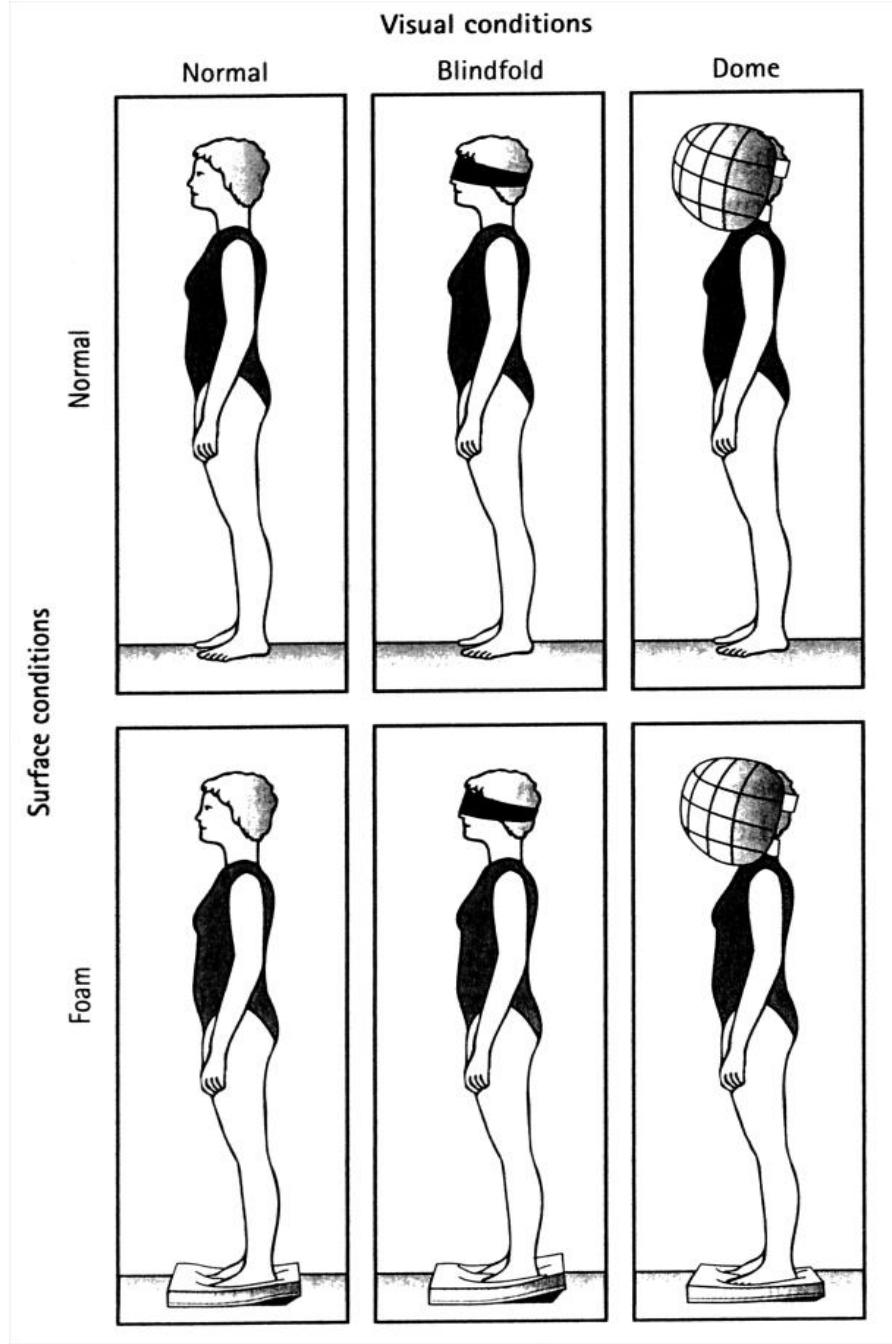

Visual conditions
Normal
Blindfold
Dome
Surface conditions
Normal
Foam

Figure 1

Berg Balance Scale

(Berg, 1989; Berg *et al.* 1992)

14 ordinal items with five levels (0-4) : scale from 0 to 56

- Sitting to standing
- Standing unsupported
- Sitting unsupported
- Standing to sitting
- Tranferts
- Standing with eyes closed
- Standing with feet together
- Reaching forward with outstreched arm
- Retrieving object from floor
- Turning to look behind
- Turning 360°
- Placing alternate foot on stool
- Standing with one foot in front
- Standing on one foot

Mini-Best Test: 14 items (score de 0 à 28)

Anticipatory

SIT TO STAND
RISE TO TOES
STAND ON ONE LEG

Reaction

COMPENSATORY STEPPING CORRECTION- FORWARD
COMPENSATORY STEPPING CORRECTION- BACKWARD
COMPENSATORY STEPPING CORRECTION- LATERAL

Sensory orientation

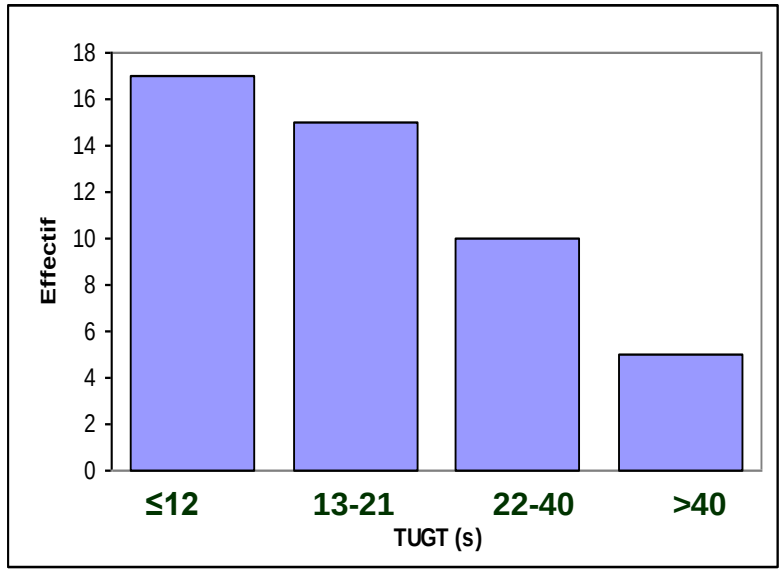
STANCE (FEET TOGETHER); EYES OPEN, FIRM SURFACE
STANCE (FEET TOGETHER); EYES CLOSED, FOAM SURFACE
INCLINE- EYES CLOSED

Dynamic gait

CHANGE IN GAIT SPEED
WALK WITH HEAD TURNS – HORIZONTAL
WALK WITH PIVOT TURNS
STEP OVER OBSTACLES
TIMED UP & GO WITH DUAL TASK

Timed Up and Go Test (TUGT)



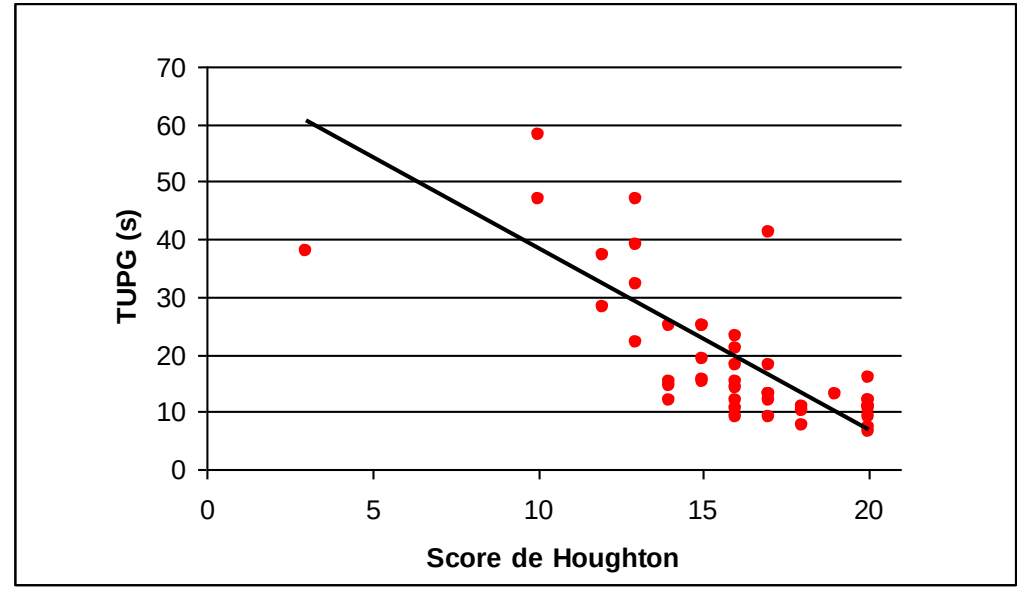


Figure 4

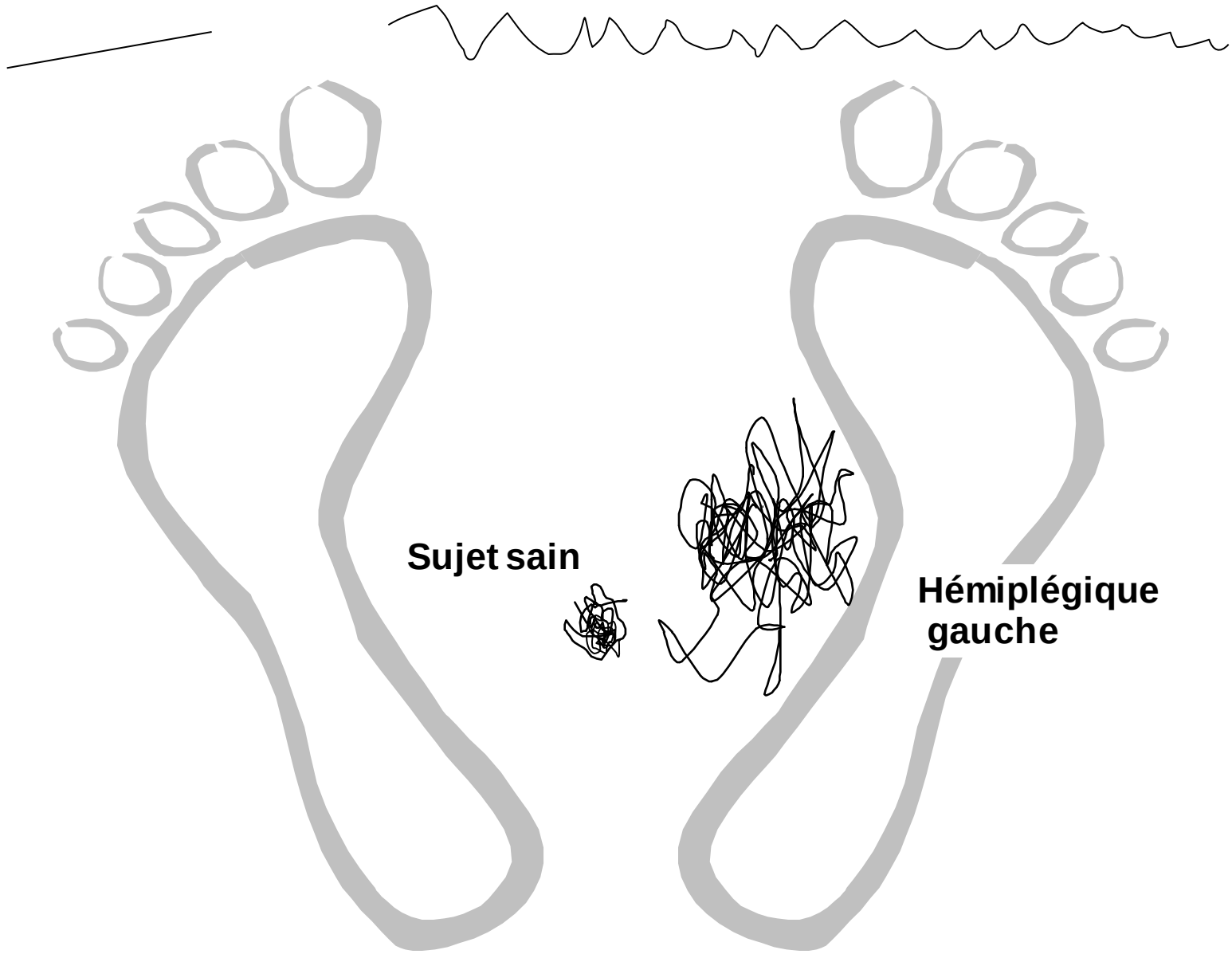
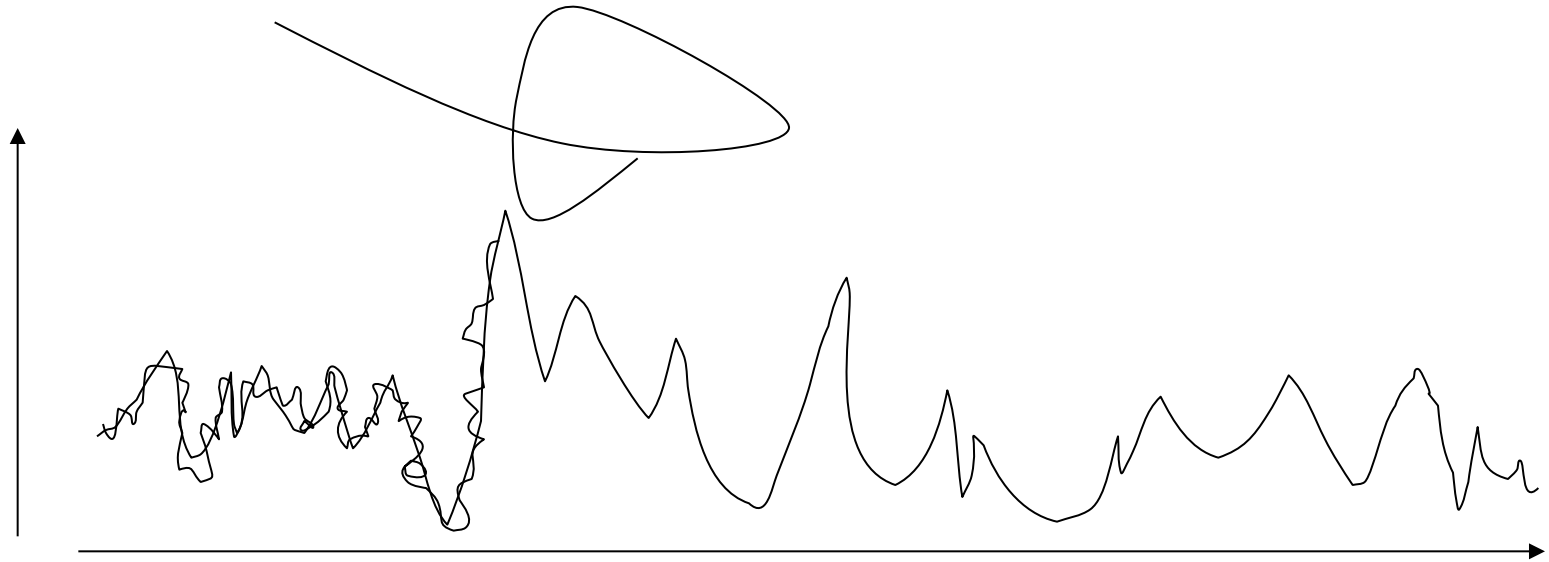


Figure 5

Coordonnées du CP: trajectoires vs déplacements



Sujet normal

Patient avec une atrophie cérébelleuse évoluée

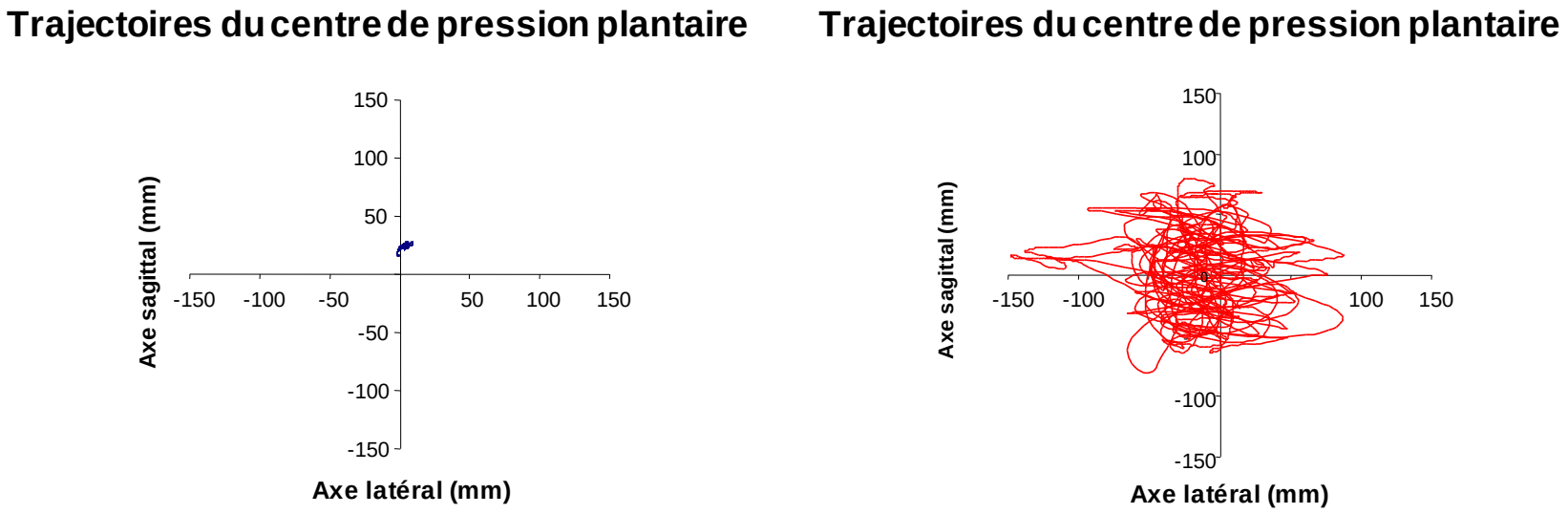


Figure 9

Outils spécifiques d'évaluation de l'orientation verticale

Score for Contraversive Pushing (SCP), Karnath et al Neurology 2000

Table 1 *Clinical assessment scale for contraversive pushing**

		Sitting	Standing
(A) Posture (symmetry of spontaneous posture)			
Score 1 = severe contraversive tilt with falling to the contralesional side		☐	☐
Score 0.75 = severe contraversive tilt without falling		☐	☐
Score 0.25 = mild contraversive tilt without falling		☐	☐
Score 0 = no tilt / upright body orientation		☐	☐
	Total (max = 2):		
(B) Extension (use of the arm/leg to extend the area of physical contact to the ground)			
Score 1 = performed already in rest		☐	☐
Score 0.5 = performed not until position is changed		☐	☐
Score 0 = no extension		☐	☐
	Total (max = 2):		
(C) Resistance (resistance to passive correction of posture to an upright position)			
Score 1 = resistance is shown		☐	☐
Score 0 = resistance is not shown		☐	☐
	Total (max = 2):		

* Translated from Karnath H-O, Brötz D, Götz A. Clinical symptoms, origin, and therapy of the "pusher syndrome." Nervenarzt: In press.

Evaluation de la lateropulsion

Scale for contraversive pushing (SCP)

Burke Rehabilitation Scale (BLS)

SCALA

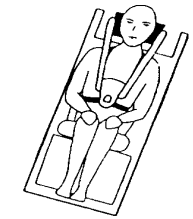
Measuring verticality perception: VV and PV

Visual vertical (VV)

Witkin et Asch , 1948

Normality from -2.5° to + 2.5°

Vision and otolithic graviception



Postural vertical (PV)

Clark and Graybiel, 1963

Normality from -2.5° to + 2.5°

Somaesthetic graviception

Visceral graviceptors

Proprioception

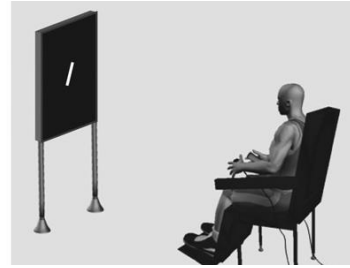
Cutaneous pressure

Mesuring the visual vertical: myriad of protocols

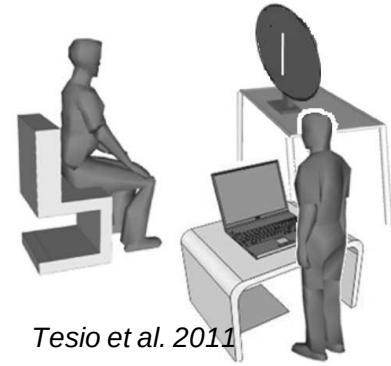
Hemispheric dome
Dieterich and Brandt 1993

Bucket test
wergal et al. 2009

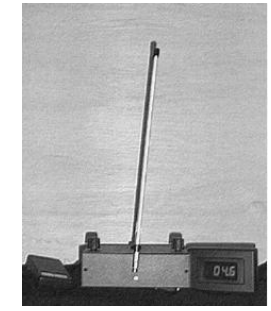
C-RFT line
Bagust 2005

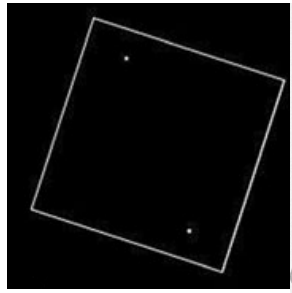


Lopez et al. 2008

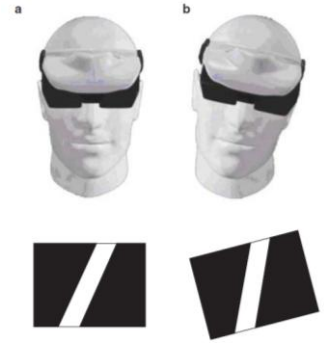


Tesio et al. 2011

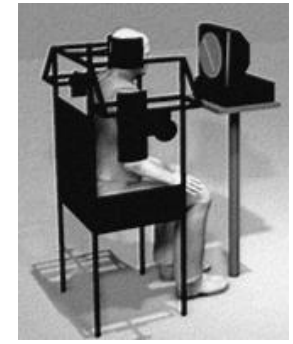




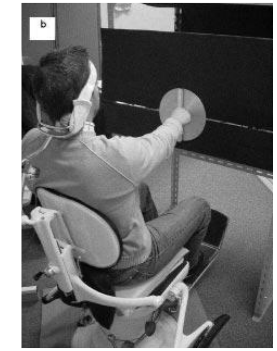
C-RFT dots
Gosselin et al. 2014



Suarez et al. 2012

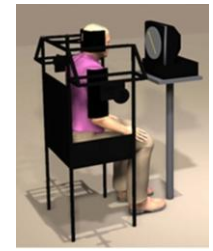


Pérennou et al. 2008



Saj et al. 2005
Rousseaux et al. 2013

Provided the trunk (and head) is maintained : VV measure is reliable in subacute stroke patients with postural disorders



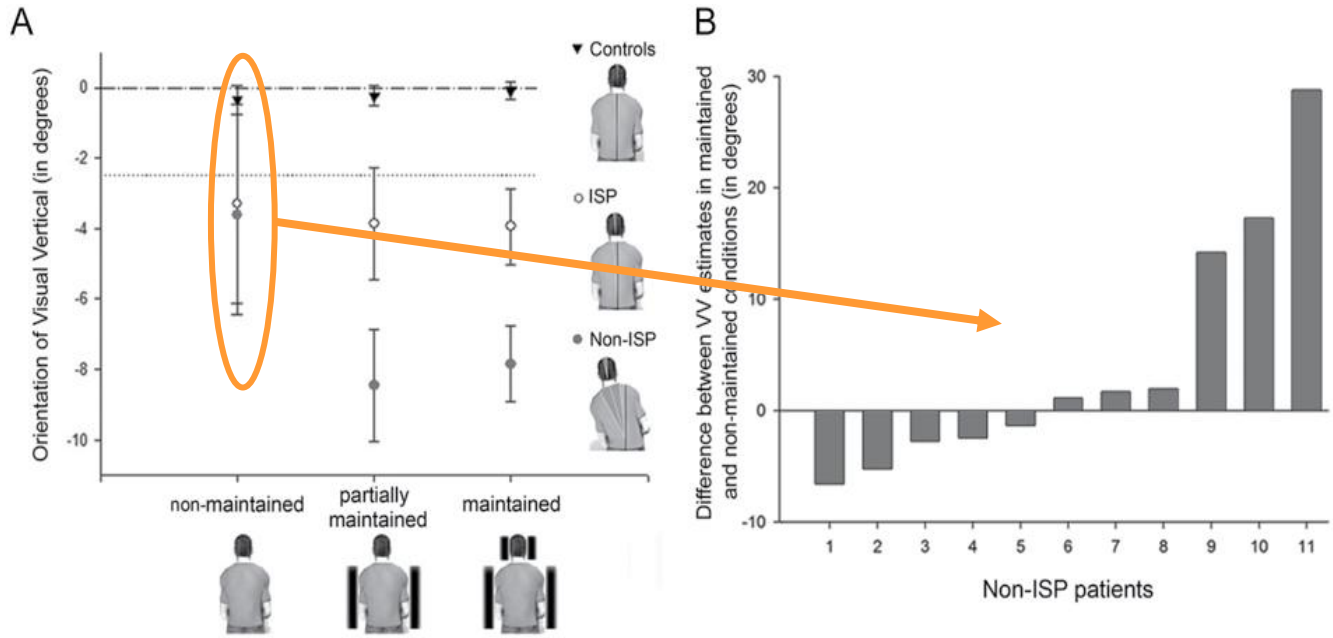
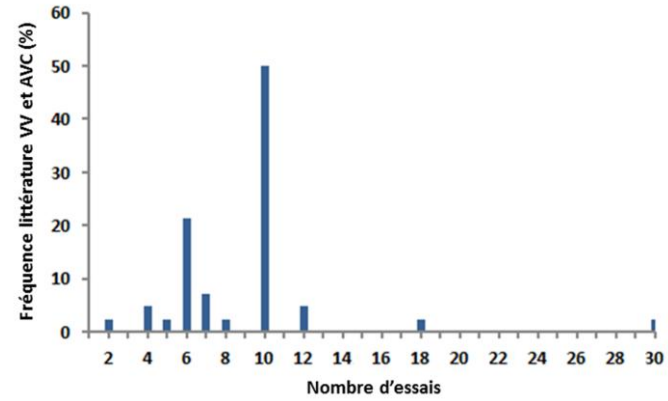


Figure . (A) Visual vertical (VV) orientation as a function of group (controls, patients with Independent Sitting Posture [ISP] and without [non-ISP]) and setting (nonmaintained body, partially maintained body, maintained body). The error bars represent the standard error of the mean. (B) Individual differences between VV estimates in the maintained and nonmaintained settings for the 11 non-ISP patients. Positive values indicate a more contralesionally biased VV and negative values an ipsilesional VV bias in the nonmaintained setting

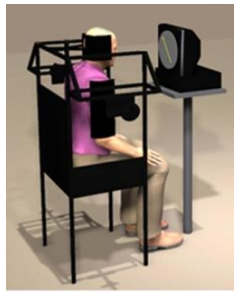
Piscicelli et al, NNR 2016

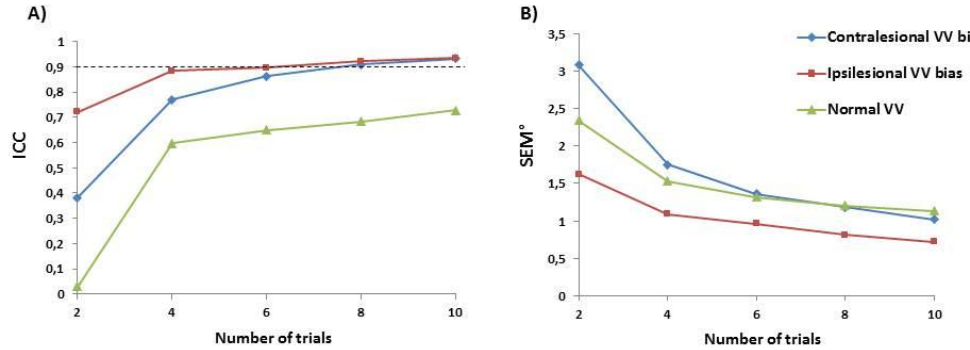
VV : number of trials required optimum 10, minimum 6

Number of trials used in the literature in stroke patients



Reliability of the VV as a function of the number of trials to make a test

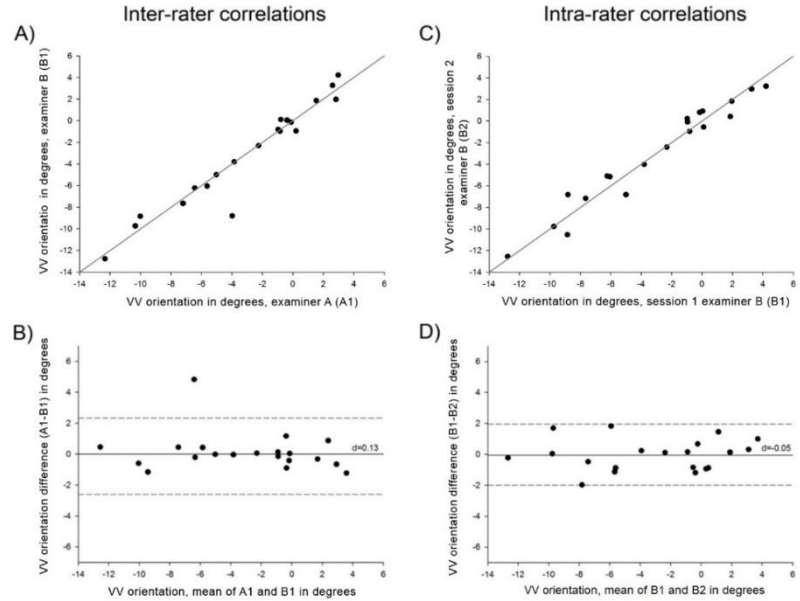




Piscicelli et al, BMC Neurol 2015

High inter and intra rater reproducibility (orientation index)

	ICC	*SEM*	*MDC 95 %*	*MDC 90%*
VV orientation				
Inter-rater reliability (A1 vs B1)	*0.979*	*0.67°*	*1.85°*	*1.56°*
Intra-rater reliability (B1 vs B2)	*0.982*	*0.63°*	*1.74°*	*1.46°*
VV uncertainty				
Inter-rater reliability (A1 vs B1)	*0.211*	*0.94°*	*2.62°*	*2.2°*
Intra-rater reliability (B1 vs B2)	*0.836*	*0.55°*	*1.54°*	*1.3°*

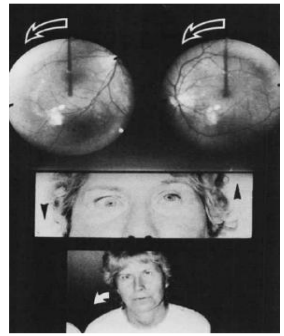


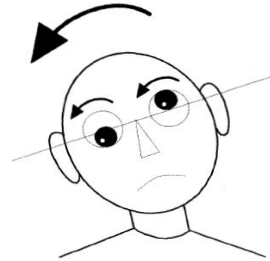
Piscicelli et al, stroke 2015

The problem is that VV is poorly correlated with postural disorders

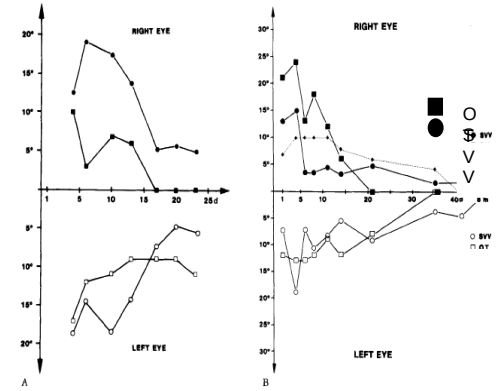
Kerkhoff et al EBR 1998, Bonan et al APMR 2006, JNNP 2007, Pérennou et al Brain 2008

Tilted also because of an ocular torsion





From Brandt & Dieterich 1994



Two main modalities for measuring verticality perception in routine in a clinical context

Visual vertical (VV)

Witkin et Asch , 1948

Normality from -2.5° to + 2.5°

Vision and otolithic graviception

Postural vertical (PV)

Clark and Graybiel, 1963

Normality from -2.5° to + 2.5°

Somaesthetic graviception

Visceral graviceptors
Proprioception
Cutaneous pressure

Mesurer la verticale posturale
- Wheel paradigm -

Noir complet

Tête, tronc, membres tenus

Suject aléatoirement incliné (15-45°), puis ramené dans la direction opposée jusqu'à se percevoir vertical.

Vitesse lente (1.5°/s) et constante pour réduire stimulation canaux semicirculaires

Gravicepteurs viscéraux,Proprioception, Pression cutanée

Dites "stop" lorsque vous êtes vertical

Inclinaison mesurée avec inclinomètre

Sujets normaux réalisent cette tâche très précisément, limites de normalité -2.5° à +2.5°
Valeurs positives pour inclinaisons droites (normaux) or ipsilesionelles (patients)

Pérennou et al Brain 2008

VP teste graviception somaesthesique

Evaluation de la rétropulsion

Pull test, unexpected pull test

Backward desequilibrium Scale (BDS)

Figure 7

Backward Disequilibrium Scale BDS

(Manckoundia et al 2007)

5 tâches posturales courantes:

- Se lever d'une chaise
- Tenir debout YO
- Tenir debout YF
- S'asseoir
- Tenir assis au bord d'une chaise

Scale for retropulsion

(Bergmann et al 2022)

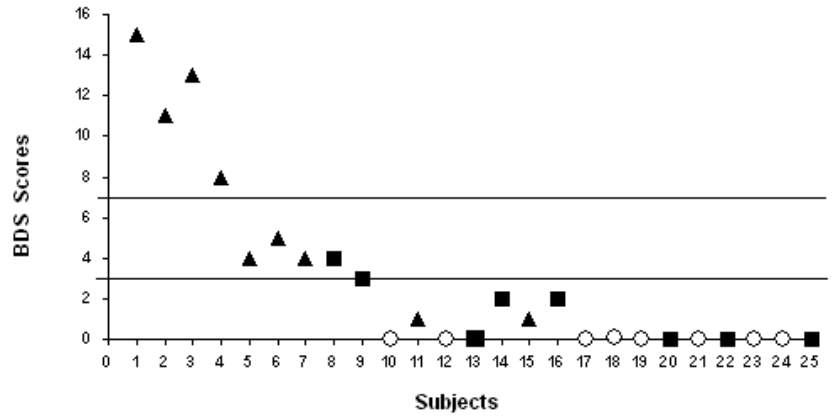
Cotations du BDS

- Chaque item est côté de 0 à 3
  - 0: tâche réalisée sans rétropulsion
  - 1: tâche réalisée avec légère rétropulsion
  - 2: tâche difficilement réalisée à cause de la rétropulsion. Plusieurs essais nécessaires
  - 3: tâche impossible du fait de la rétropulsion

TOTAL SUR 15

Individual Data

A



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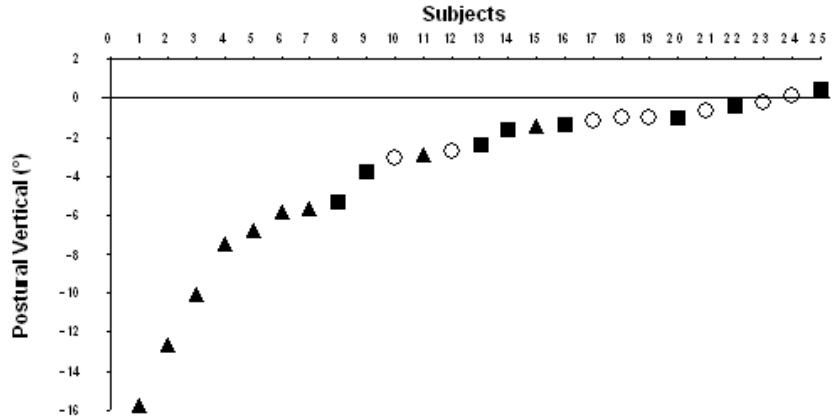

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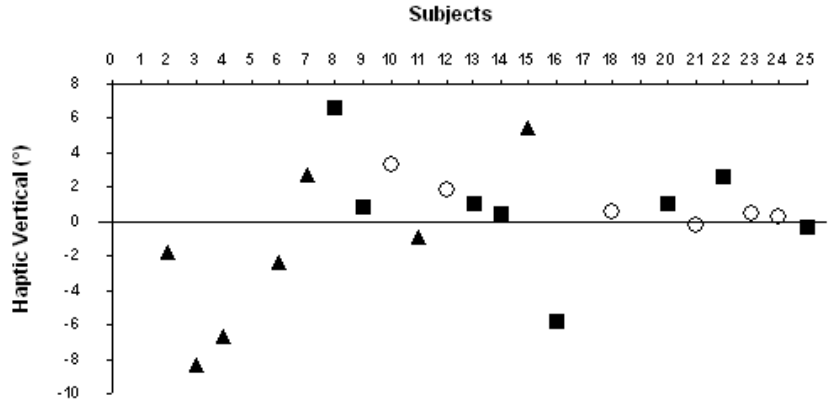


Manckoundia et al 2007

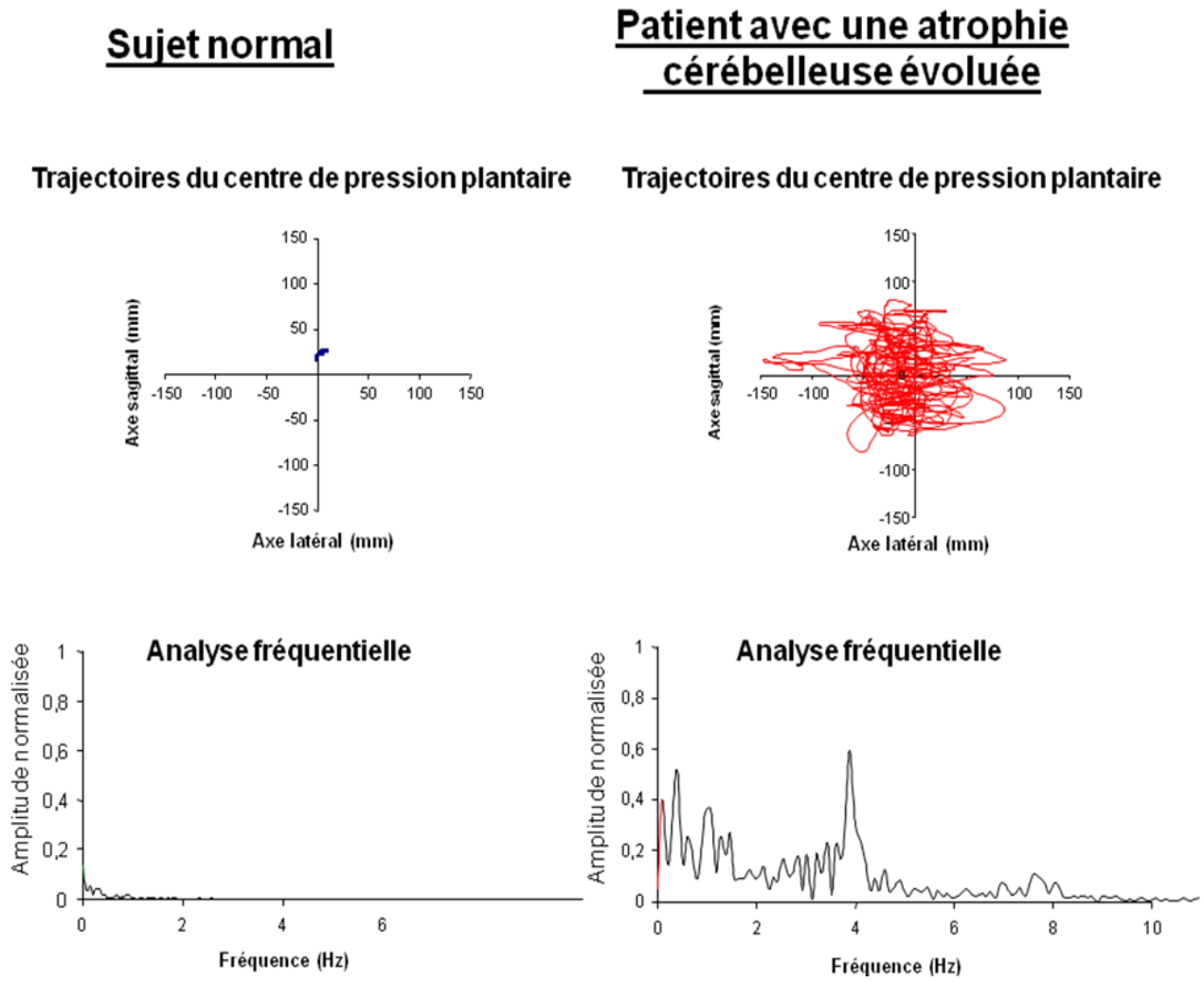
5 times STST

Outils spécifiques de la stabilisation posturale

Posturographie

Time to maintain the single limb stance

L'ataxie cérebelleuse : Oscillations posturales amples à fréquence haute

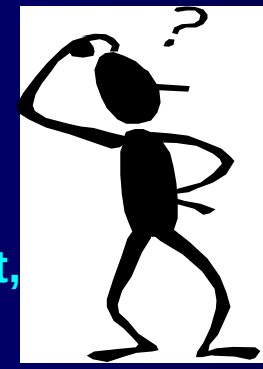


D'après Pérennou et al, Ann Réadapt Med Phys 2005

Outils spécifiques d'évaluation du contôle postural (équilibre) après AVC

Evaluations spécifiques AVC

Which one is the best clinical scale?



1) Non stroke-specific balance scales

Berg Balance Scale, get up and go, single limb stance timed test, Sensory organisation test…

Often difficult to perform by stroke patients ⇒ floor effect

2) Non balance-specific motor scales dedicated for stroke:

Fugl-Meyer, MAS ...

⇒ impairment and disability mixture

⇒ Not enough informative about postural control

3) Postural scales especially dedicated for stroke patients

Short tests for sitting and/or standing postures: Bourges scales, Bohannon scales, Trunk Control Test, Pushing scale, and many other *ad hoc tests*…

⇒ ceiling effect

PASS : broadly and objectively scans postural capacities

PASS : 12 ordinal items with 4 levels

Guideline for objective scoring: *stroke 1999*, full text available on the web

Lying

- Roll to the weak side
- Roll to the strong side
- Sit up from lying down

Sitting

- Maintain
- Lying down
- Standing up

Standing

- Keep standing with help
- Keep standing without help
- Sit down
- Pick up a pencil from the floor
- Non paretic leg
- Paretic leg

Score range : 0-36

Scoring PASS items

Maintaining a posture

Sitting without support *(sitting on the Bobath plane - with the feet touching the floor)*

0 = cannot sit; 1 = can sit with slight support, for example by one hand; 2 = can sit for more than 10 seconds without support

3 = can sit for 5 minutes without support

Standing with support *(feet position free, no other constraints)*

0 = cannot stand even with support; 1 = can stand with strong support of two persons

2 = can stand with moderate support of one person; 3 = can stand with only one support of one hand

Standing without support *(feet position free, no other constraints)*

0 = cannot stand without support; 1 = can stand without support for 10 seconds or leans heavily on one leg

2 = can stand without support for 1 minute or stands slightly asymmetrically ; 3 = can stand without support for more than 1 minute

Standing on one leg and *(no other constraints)*

0 = cannot stand on non-paretic leg; 1 = can stand on non-paretic leg for a few seconds

2 = can stand on non-paretic leg for more than 5 seconds; 3 = can stand on non-paretic leg for more than 10 seconds

Changing posture : **Supine to affected side lateral; Supine to non-affected side lateral; Supine to sitting up on the edge of the bed; Sitting on the edge of the bed to supine; Sitting to standing up; Standing up to sitting down; Standing, picking up a pencil from the floor**

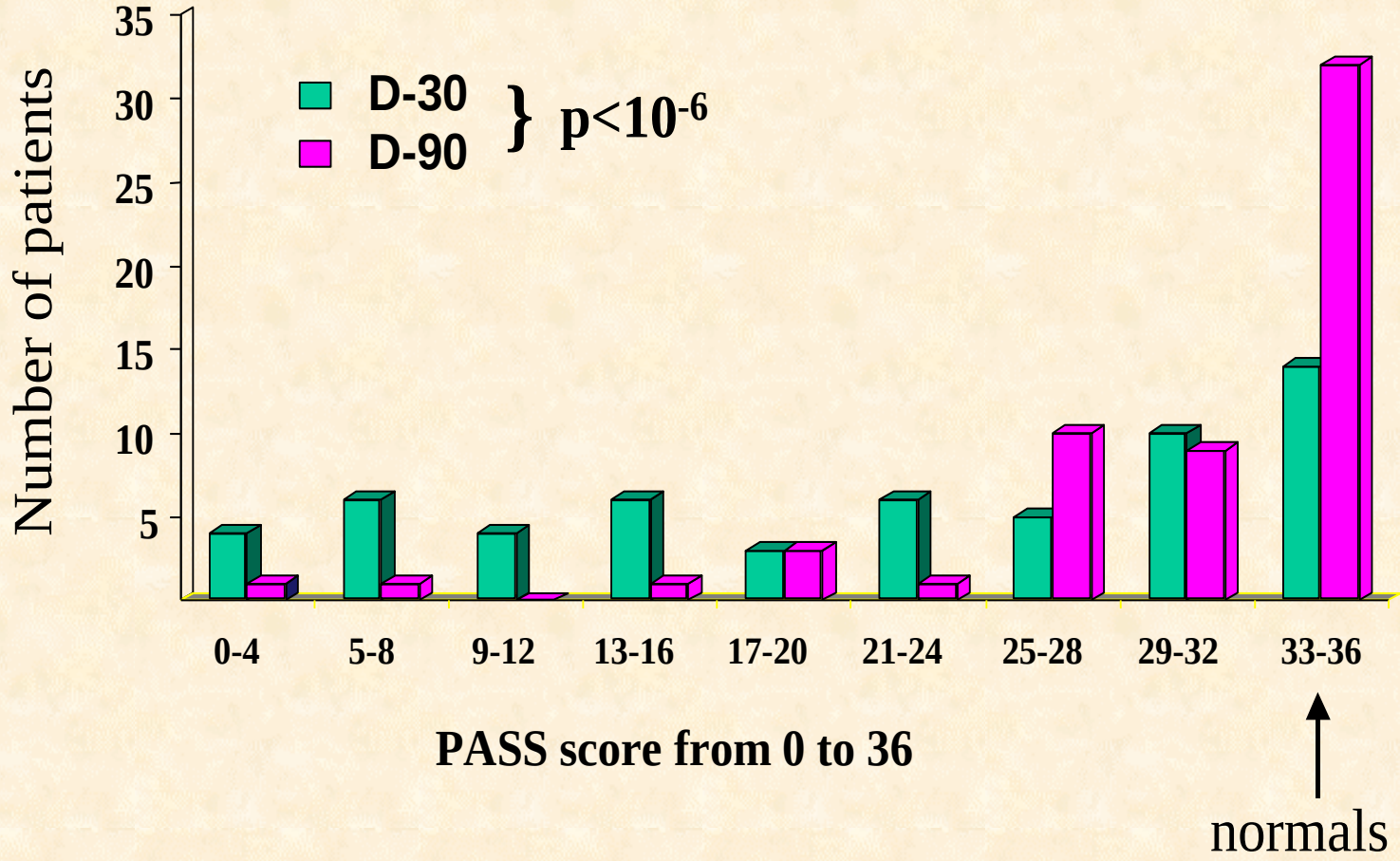
0 = cannot perform the activity, 1 = can perform the activity with much help,

2 = can perform the activity with little help, 3 = can perform the activity without help.

6.

PASS distribution

Adapted from Benaim et al. 1999



Good to very good clinimetric properties

Gogo et al in preparation

Outils spécifiques d'évaluation des de l'ataxie posturale cerebelleuse

Echelle SARA (scale for assessment and rating for ataxia)

1) La démarche- Marche en tandem aller-retour

0 Normal, aucune difficulté ni pour marcher, ni pour faire demi tour ni pour marcher en tandem (jusqu'à une faute permise)

1 Légère difficulté, visible seulement en marchant 10 pas consécutifs en tandem

2 Clairement anormal, il est impossible de marcher plus de 10 pas en tandem

3 Embardées, difficultés dans le demi tour mais réalisé sans support

4 Embardées marquées, besoin du support du mur par intermittence

5 Sévères embardées, besoin permanent d'une canne ou d'une légère aide unilatérale

6 Marche >10M uniquement avec un support important (2 cannes ou déambulateur ou un accompagnant)

7 Marche <10m uniquement avec un support important (2 cannes ou déambulateur ou un accompagnant)

8 Incapable de marcher même avec un support

Outils plutôt dédiés aux personnes âgées

Thanks for your attention

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