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FALL PREVENTION THROUGH AQUATIC THERAPY

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Universidad Rey Juan Carlos

IATF

Index

- Falls
- Balance and losing balance
- Balance strategies in humans.
- Fall prevention programs
- Aquatic Therapy: its role in fall prevention
  - Halliwick
  - Ai Chi
  - Obstacle course

FALL CONCEPT

“the result of any event that precipitates the individual to the ground, against their will"

CONSEQUENCES

ASSESSMENT OF RISK FACTORS

FALLS IN ELDERLY

Between 30% and 60% of elderly experience a fall annually, and about half of them experience multiple falls.
Rubenstein et al, *Clinical Geriatric Medicine,* 2002

The 5% and 10% of the elderly living in the community and experiencing an annual fall have a major injury.

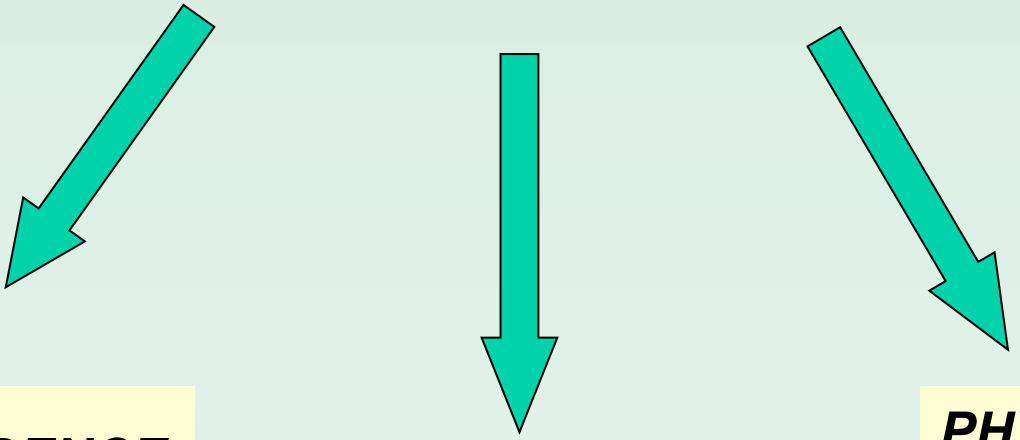
from superficial lesions, simple contusion, ecchymosis, shallow or deep laceration, dislocation, fractures, even those that endanger life

Mortality after falling represents 2% of all deaths of people aged 65 years or over (AIHW 2002) being the leading cause of injury death

Rubenstein L. Age and Ageing 2006;

FALL CONCEPT

Combination of



HIGH INCIDENCE

INJURY SUSCEPTIBILITY

PHYSIOLOGICAL CHANGES DUE TO THE AGE (strength, aerobic capac., flexibility and ability to balance)

Edelberg, 2001

FICSIT
Frailty and Injuries: Cooperative Studies of Intervention Techniques

Frailty And Injuries: Cooperative Studies Of Intervention Techniques (FICSIT) Trials

PHYSIOPATHOGENY

COMMON RISK FACTORS

ACCIDENTAL OR RELATED TO ENVIRONMENT

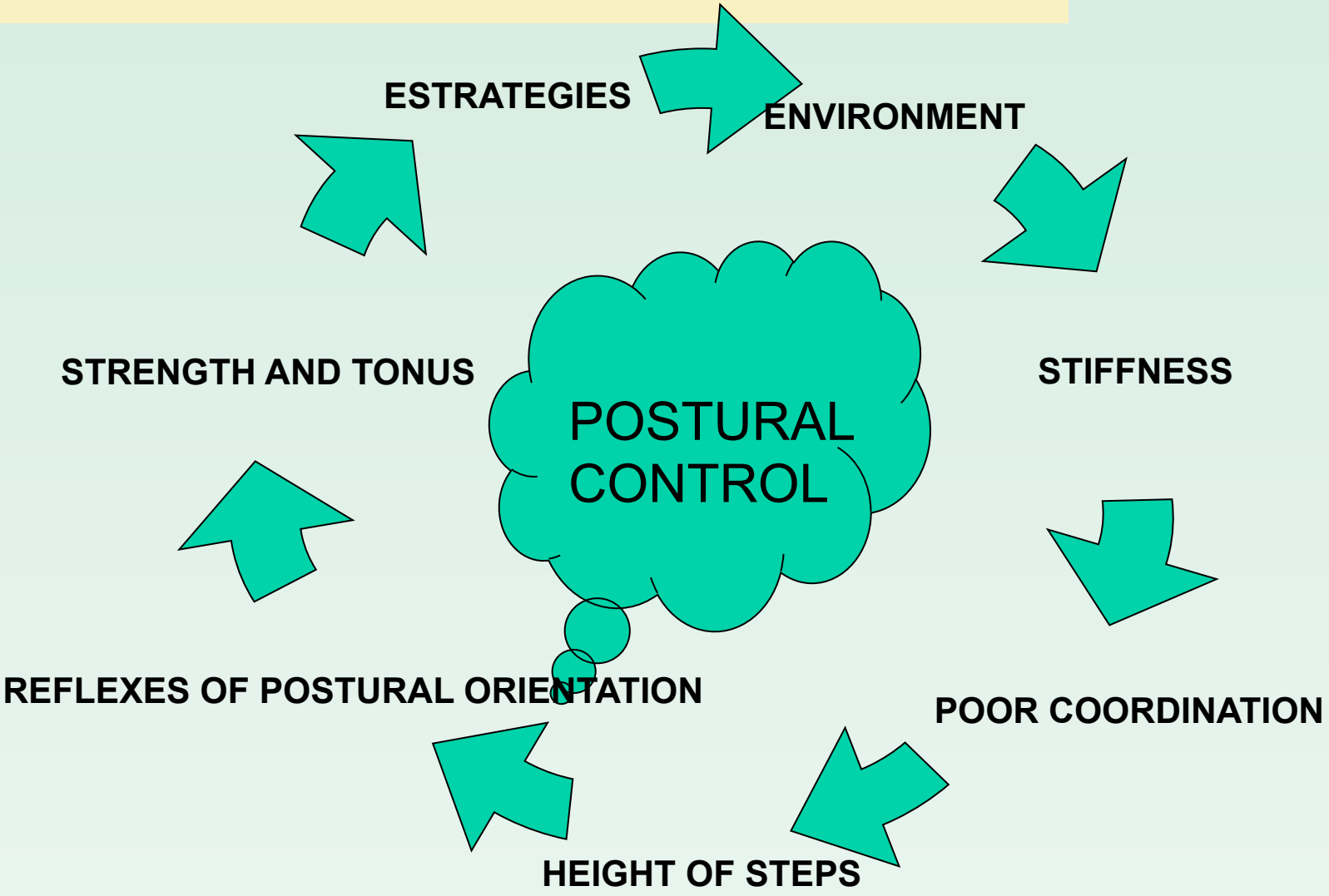
WEAKNESS OR CONDITIONS OF GAIT AND BALANCE

VERTIGO / DIZZINESS

OTHER CAUSES

FADE, CONFUSION, HYPOTENSION, SYNCOPE

ACCIDENTAL OR RELATED TO ENVIRONMENT



WEAKNESS. ALTERATIONS ON GAIT/ BALANCE

10-25% of falls

They have many etiologies

Affects Functionality of 20-40% of those> 65 years (40-60% of those> 85 years)

They are derived from

- Age-related problems
- Specific dysfunctions of the nervous system, musculoskeletal, or cardiopulmonary
- Deconditioning after immobility

BALANCE/ GAIT FACTORES

DESCENDING PATHWAYS

ASCENDING PATHWAYS

PROPIOCEPTION

LOOK

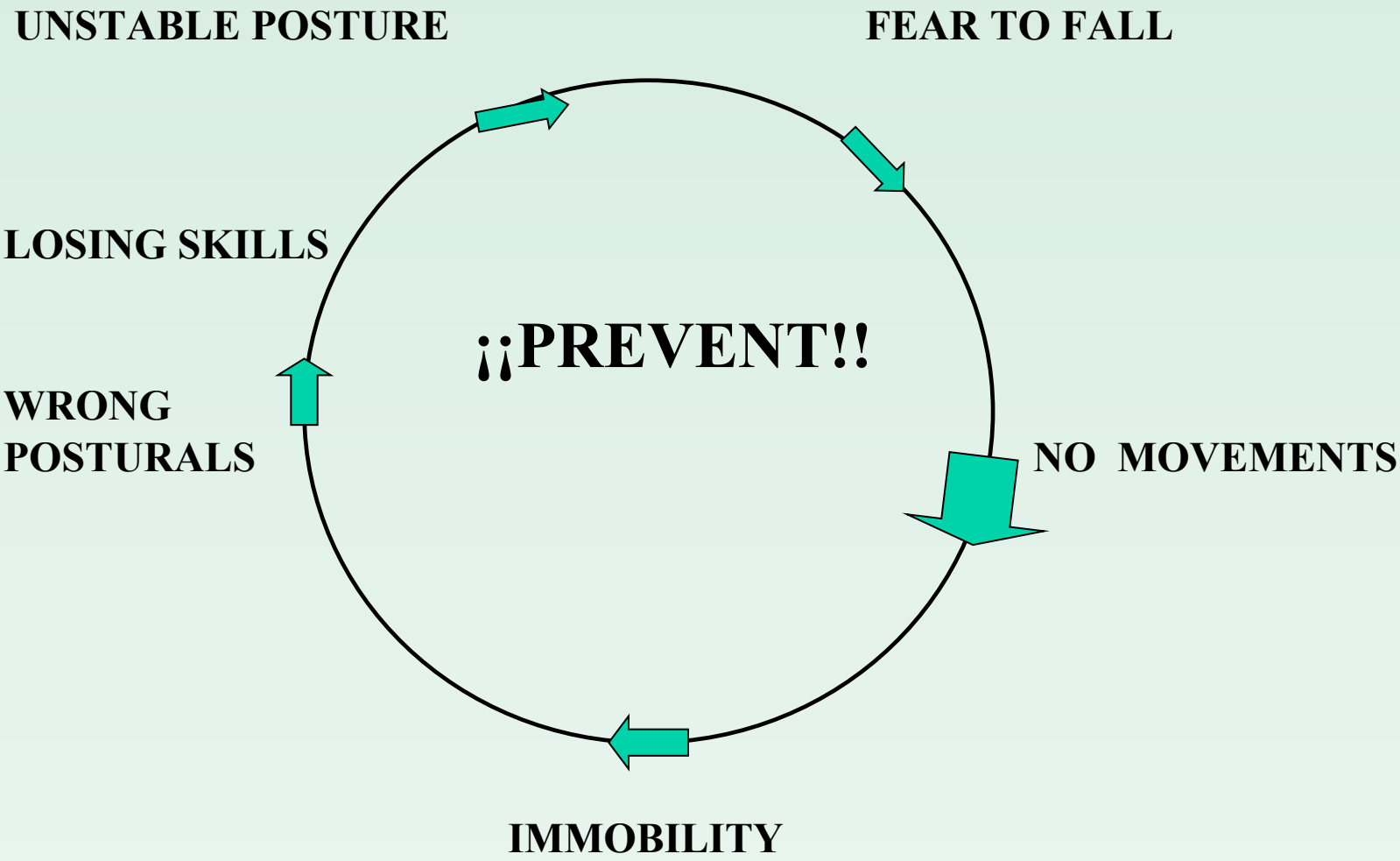
BALANCE
GAIT

VESTIBULAR

ORIENTATION

MOTIVATION

KNOWLEDGE OF NORMAL MOVEMENT (POSTURE)



Simmons & Hansen, 1997

Balance strategies non-intentional movements

- **Predictive/preparation expected prevention, = predominantly dynamic**
  - Counter-weight, dynamic reactions that accompany intentional movements
  - static mechanisms:
    - stiffening joints
    - increase base of sup.
- **Reactive/correction unexpected loss**
  - Ankle/hip strategies
  - Insecurity strategy
  - Stumble strategies
    - Sideways, backward
    - Forward
  - Arm strategy
  - Fall strategy

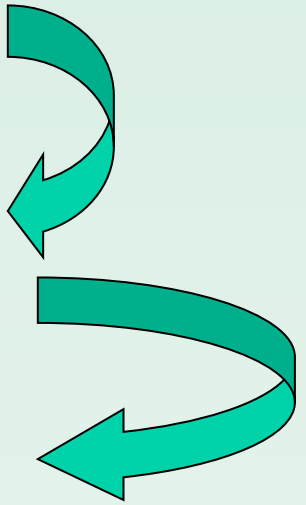
Guccione 2001, Bronstein 2004, Pijnappels 2005, Rose 2010

Intentional movements

- Initiation (start / stop)
- Maintaining weight load during a task
- Functional reach limits with concentric and eccentric activity
- Standing on one leg

ESTRATEGIES FOR STANDING
on unexpected loss

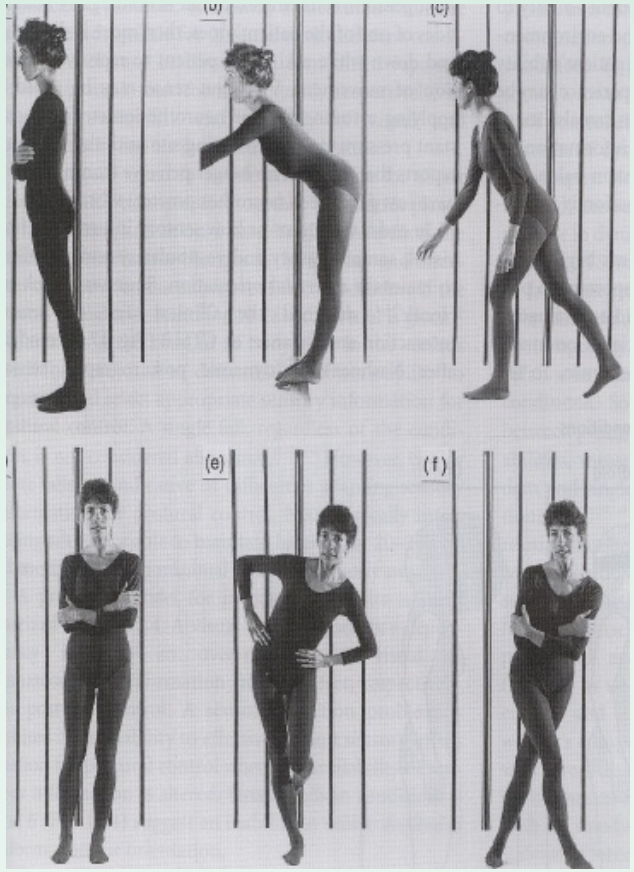
- ANKLE STRATEGY
- HIP STRATEGY
- STUMBLE STRATEGY



NO TIME TO CORRECT= FALL

Bronstein A, et al (2004)Clinical disorders of balance, posture and gait

HIP ESTRATEGIES



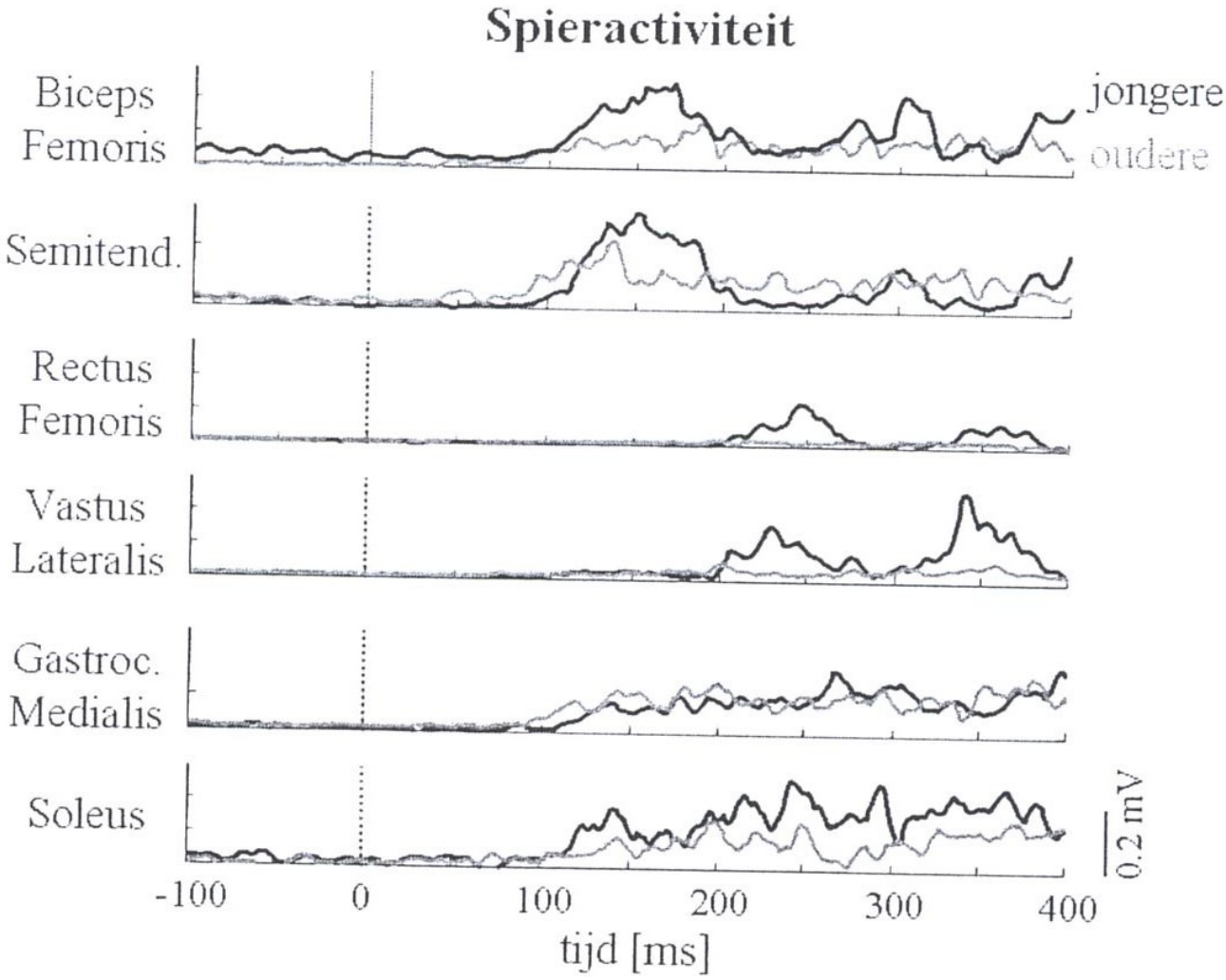
A.Suspension strategy
B.Stepping strategy
Pijnappels M. *Fysiotherapie en Ouderenzorg, 2005*

>> stumbling sideways is more dangerous: femoral neck fractures!! > Walk fast!

STUMBLE

- Elderly who fall are able to increase their balance restoration after 3-5 reactions stumbling through better positioning of pendulous Lower Limb.
- The stumble should be trained in a safe environment --- WATER

Pijnappels, 2005. *Vakblad NVFG*



Muscle activity during stumbing. 0 = collision. Reaction times are similar, but amount of muscular activity (increase) differs.

Pijnappels, 2005

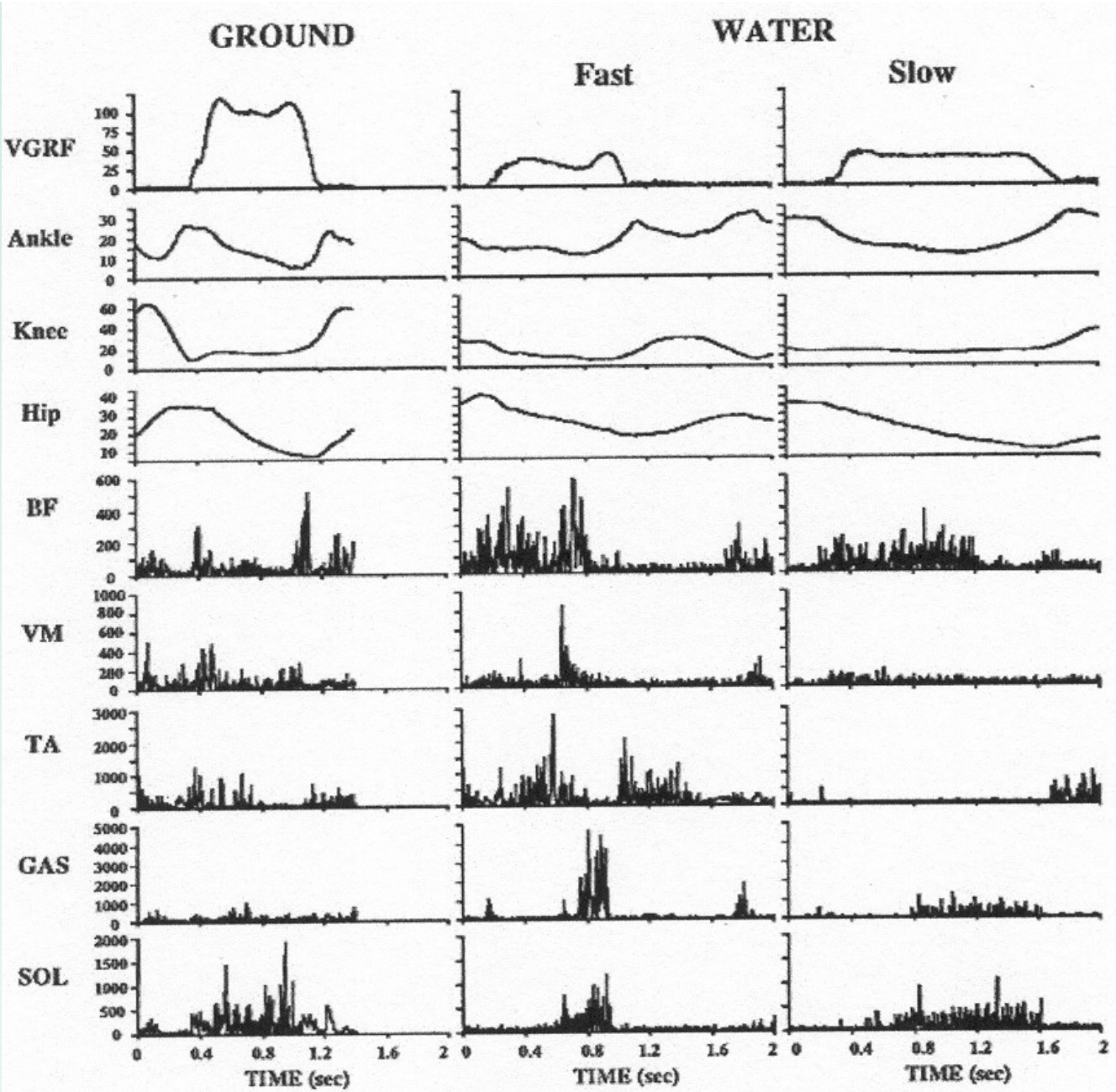


Fig. 1 Ground reaction forces; VGRF (%BW), lower joints displacement; Hip, Knee, Ankle (deg), and full-wave rectified EMGs (a.u.) during the three different walking conditions.

Negociate/avoid obstacles

- Short step and long step strategy
- Research:
  - Reaction speed can hardly be influenced
  - Elderly choose the long step
    - Hamstrings have too less braking force to rely on a short step
  - Long step often too short and low
- Training: elongate and heighten the step

BALANCE PROBLEMS FOR SPECIFIC SETS OF INTENDED MOVEMENTS

- Keeping the weight support during a task
- Limitations of reach
- Leg stance
- Negotiation / obstacle avoidance
  - Inclusion of other limitations as cognitive dual tasks, darkness etc.

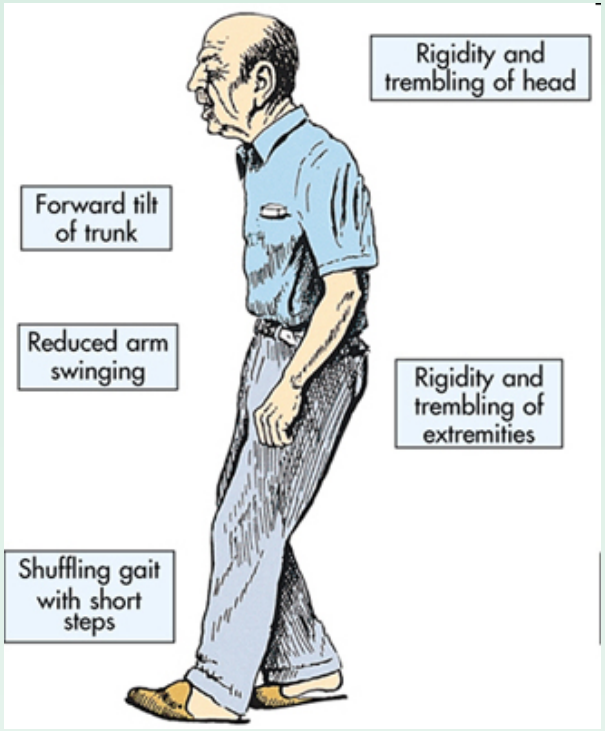
Nijmegen fall prevention

payed by insurance because: evidence based
Weerdesteyn 2004

- Based on:
  - the “stimulating landscape” Mulder
  - Stumble research. Duysens

- Components:
  - Obstacle course + double tasks
  - Group activities (anticipate other people)
  - Learning to fall (judo)
  - T’ai Chi
  - Halliwick in a pilot study (Smulders, 2003)

SPECIFIC ASSESMENT IN WATER. HALLIWICK



1. **Mental Adjustment**
2. **Change positions**
3. **Maintain positions**
4. **Movement**
5. **Balance, muscular tonus, flexibility, sinergy selection, strength etc.**

ICF ACTIVITY DOMAINS IN HALLIWICK

- Change in basic body positions: d 410
  - Sagital Rotation Control
    - Change Centre of Gravity (COG)
  - Transversal Rotation Control
    - Change COG, sit down/stand up, go to supine/prone vv and stand up
  - Longitudinal Rotation Control
    - Change COG, turn on standing, turn on supine to prone vv
  - Combined Rotation Control
    - SRC + LRC o TRC + LRC : fall forward and to both sides, stand up from the side

Lambeck & Gamper. 2007

ICF ACTIVITY DOMAINS IN HALLIWICK

- Transfers for yourself: d 420
  - Entry and exit
- Lifting and moving objects: d 430
  - Several possibilities in MA, SRC, BIS
- Moving objects with lower extremities: d 435
  - Push: objects on the floor, from wall = MA, LRC, BM
  - Kick: kicks swimming = adapted BM and harder
- Fine manual dexterity: d 440
  - Grab or pass objects, holding a trumpet (musical bubbles), releasing = most of 10 points
- Using the arm: d 445
  - Pulling, pushing, reaching, splashing water = most of the 10 points

Lambeck & Gamper.2007

WST-HALLIWICK
10 Points Program in Fall Prevention

1. Breathing Control. MENTAL ADJUSTMENT

2. Security!!! Mental Inversion
3. TRC . Stand up.

SECURITY

4. Learn to fall and stand up. CRC
5. BIS. Balance in Stillness
6. SRC y TRC. Transfers, funtional reach, Ai Chi
7. Perturbations
8. Obstacle course. Gait, groups, etc.

FUNCTIONALITY

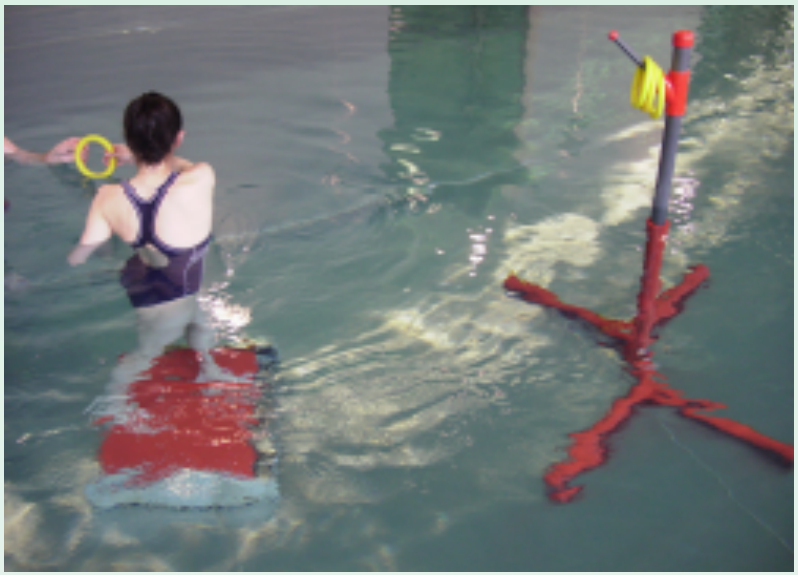
Güeita 2011, Chile

OBSTACLES COURSE

Course with stops

Functional Tasks

Specific Material



Lambeck & Gamper 07

Obstacle course

- Different surfaces as on the street
- Strips of carpet as inside
- Ducking under e.g. washing lines
- Small passages: walking around chairs
- Reaching and climbing
  - With cognitive double tasks, dimmed light, a tray in front, passing each other etc

K. Mead 1996, H.Rijken 2004

EXERCISE TRAINING PROGRAM WITH PERTURBATION.

Melzer I. BMC Geriatrics 2008

They train the balance as a functional skill that is.

Specific intervention for balance

Looking QUICK STEP as protective strategy to avoid falling

Looking to increase distance and speed of the STEP and reduce the variety of step responses in elderly

- **Level 1**: Standing exercises with external support
- **Level 2**: Standing exercises including double leg stance with no external support
- **Level 3**: Standing exercises including single leg stance with no external support.
- **Level 4**: Gait exercises, dynamic base of support with no external support.
- **Level 5**: Perturbation exercises, for improving reactive and proactive responses

SUMMARY: WHAT TO INCLUDE?

- **Challenging activities**
  - Reduce base support
  - No hands are used to support
  - Constant movement of the COG
- **Lateral safety and stability**
  - Quick Cross Steps
  - Side Long Steps
  - Maximum of 2 steps, stop and remain
- **Approach and cross the limits of scope**
  - Increase range distance
  - Falling and standing

What else?

- **Take steps over obstacles**
  - Doing swing phase longer
  - Increasing knee flexion
  - Activate plantar flexors
- **Increasing variability in the gait to mobilize the trunk**
  - Wean the movements of the head, thorax, pelvis
  - Spatiotemporal gait variations
- **Balance with distraction**
  - Cognitive tasks, crowds, visual distraction
- **Reply to unexpected perturbations**
  - While they stand
  - While they walk
  - Provocate by surfaces

Evidence in water:

Halliwick, Ai Chi with balance and obstacle course strategies focused on intentional and non-intentional balance in the levels of ICF body function and activity

Publicaciones: equilibrio e hidroterapia

Author	Quality	effects	patients	test
Lord, 1993 CCT	2/10, 3a	Positive ss	Elderly	Body sway
Morris, 1996	4	Positive	CVA	F. Reach
Simmons, 1996 RCT	3/10, 2b	Positive ss	Elderly	F. reach
Maginnis, 1999	4	positive	Elderly	Berg, TUG
Muhlenkamp, 2000	2b	Positive ss	Elderly	POMA
Thorpe, 2000	4	Positive ss	CP case	Functional reach
Suomi, 2000 RCT	4/10, 2b	Positive ss	RA and OA	Postural sway
Johnston, 2002	4	Positive	Parkinson	Berg
Suomi, 2003 RCT	5/10, 2b	-----	RA and OA	Modified TUG
Douris, 2003 CCT	3/10, 3a	Positive ss	Elderly	Berg
Yozbatiran, 2004 RCT	3/10, 2b	Positive	CLBP	Stance 1 leg
Smulders, 2005	4	Positive ss	Elderly	ABC
Devereux, 2005 RCT	7/10, 1b	Positive ss	Osteoporosis	Step test
Berger 2005 RCT	1b	Positive ss	LE trauma	Postural sway

Publicaciones: equilibrio e hidroterapia

Author		Quality	Effects	patients	test
Roller 2008	CCT	6	Positive ss	Elderly	Berg
Melzer 2008	RCT	5	Positive ss	Elderly	Step Test
Kaneda 2008		4	Positive ss	Elderly	Berg, T&G
Resende 2008	CCT	3	Positive ss	Elderly	Berg, T&G
Silva Carvalho, 2009		4	Positive ss	Elderly	Berg
Anderson 2010	RCT	4	Positive	Elderly	T&G, 6min
Arnold 2011	RCT	5	Positive	Elderly	Activities-specific Balance Confidence Scale
Vivas 2011	RCT	4	Positive	Parkinson	FRT, Berg, UPDRS, 5-m walk test and T&
Bayratkar 2013		3	Positive	MS	T&G

CONCLUSION

- Combination of factors.
- There is no one single test that encompasses all aspects of the multidimensional nature of the fall.
- In water, patients challenge their stability limits without fear of consequences of falls.
- They have more time to react because the viscosity slows movement through the water.
- Aquatic Therapy reduces anxiety to face tasks that produce fear of falling off.
- There is difficulty to standardize strategies. The best programs are always multifactorial.

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