Training static and dynamic stability using underwater obstacles

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The obstacle course is designed to train balance strategies

- Predictive to expected perturbation
- Anticipatory Postural Adjustments
- Negotiating obstacles
- Reaching to limits

- Reactive to unexpected loss

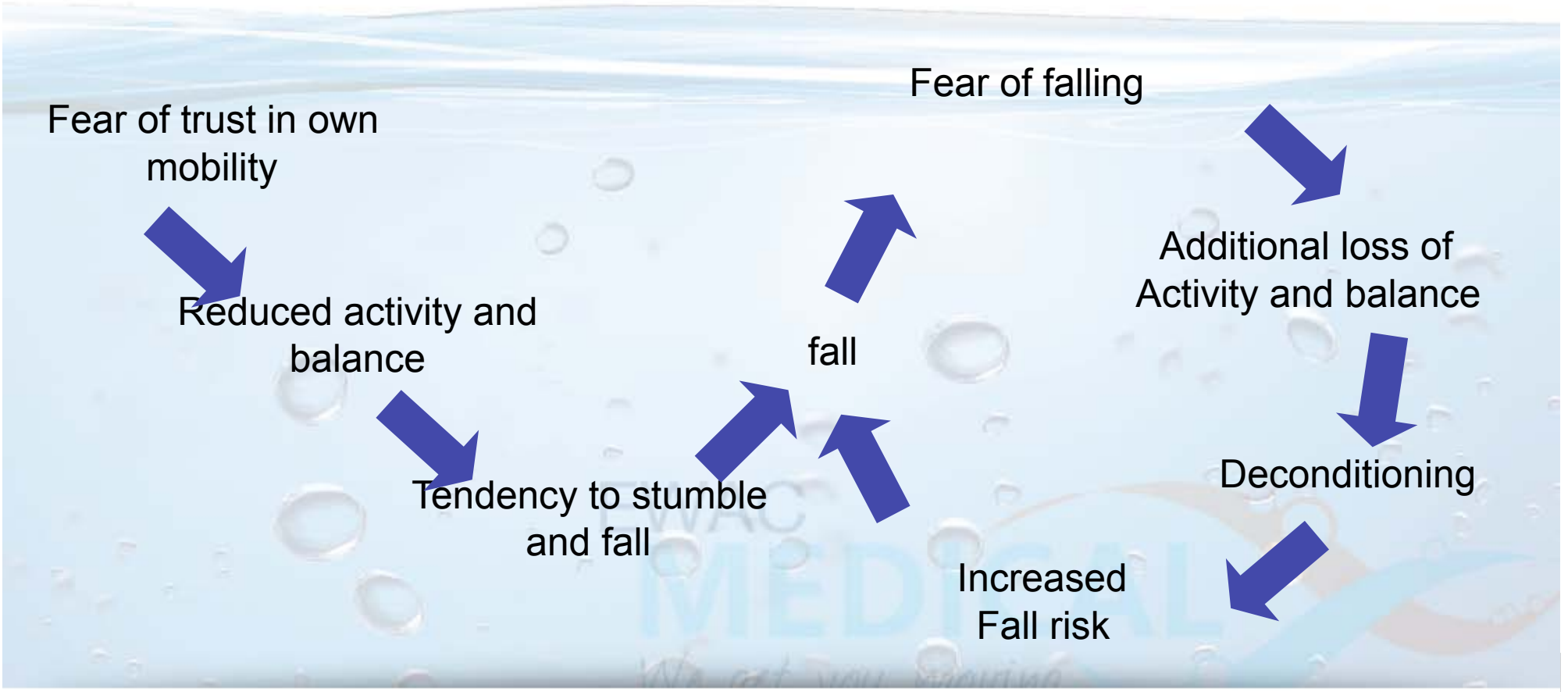
  - Ankle strategy
  - Hip strategy
  - Stumble / protective stepping strategy
    - Sideways
    - Forward

Bronstein cs 2004, Shumway-Cook

Definitions

- Dynamic stability: control of the COG while changing the BOS on purpose
  - > gait with obstacle negotiation
- Static Stability: control of the COG while the BOS should remain stationary
  - > wobble board with (unexpected) perturbations

Water: to cut the fall circle



Negotiating obstacles and stumbling

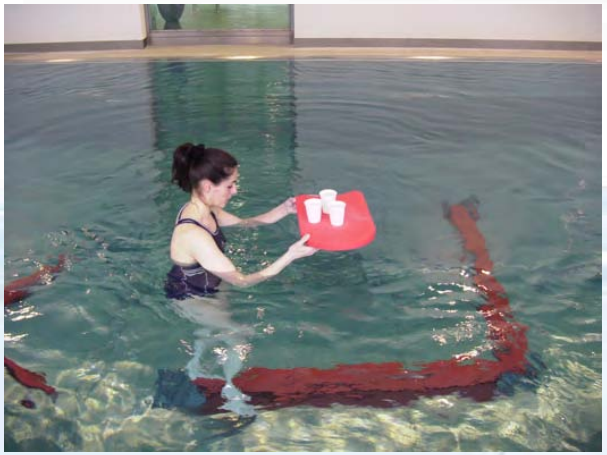
- Stumbling is – with 19% - the largest reason of falls in home dwelling elderly older than 75.
  - Inside (carpet, electrical cord etc)
  - Outside (uneven pavement etc)
    - Avans 2004
- Stroke patients have difficulties to negotiate/cross obstacles by not adequately adapting their short or long step strategies, leading to falls
  - Van Swigchem 2013
- Tripping over obstacles is among the most commonly reported causes of falls, esp when unexpected dual-tasks have to be performed that challenge attention demands.
  - Kim & Brunt 2007, APMR

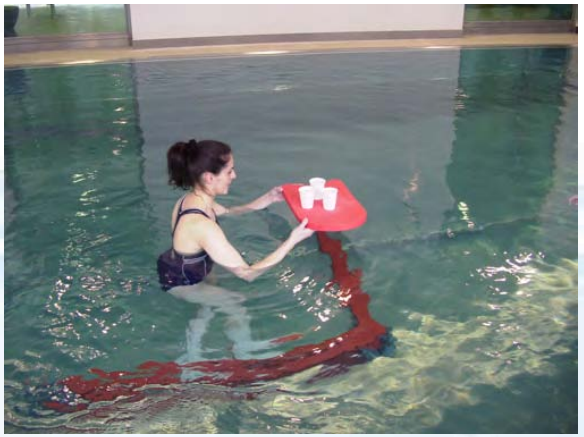
Obstacle courses: stroke

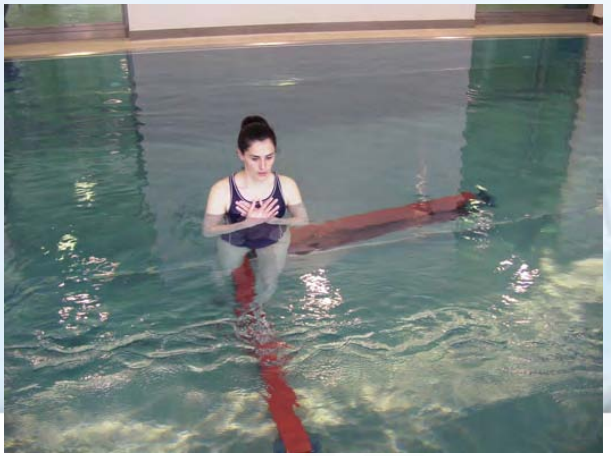
- English et al (2012): review of literature

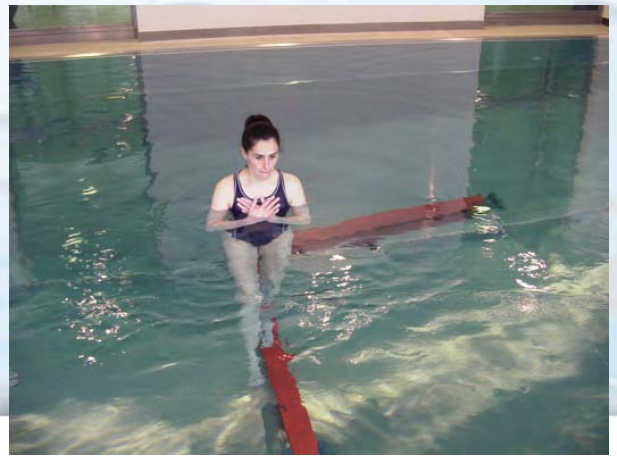
	Improve adaptability of walking skills	Obstacle courses (include over low obstacles, steps, ramps, foam surfaces)	Dual tasking (eg carrying tray of objects) Picking up objects from floor	English et al., 2007; Dean et al., 2000; Blennerhassett & Dite 2004; Salbach et al., 2004; Pang et al., 2005; Marigold et al., 2006; Mudge et al., 2009; van de Port et al., 2009; Rose et al., 2010

Obstacle course









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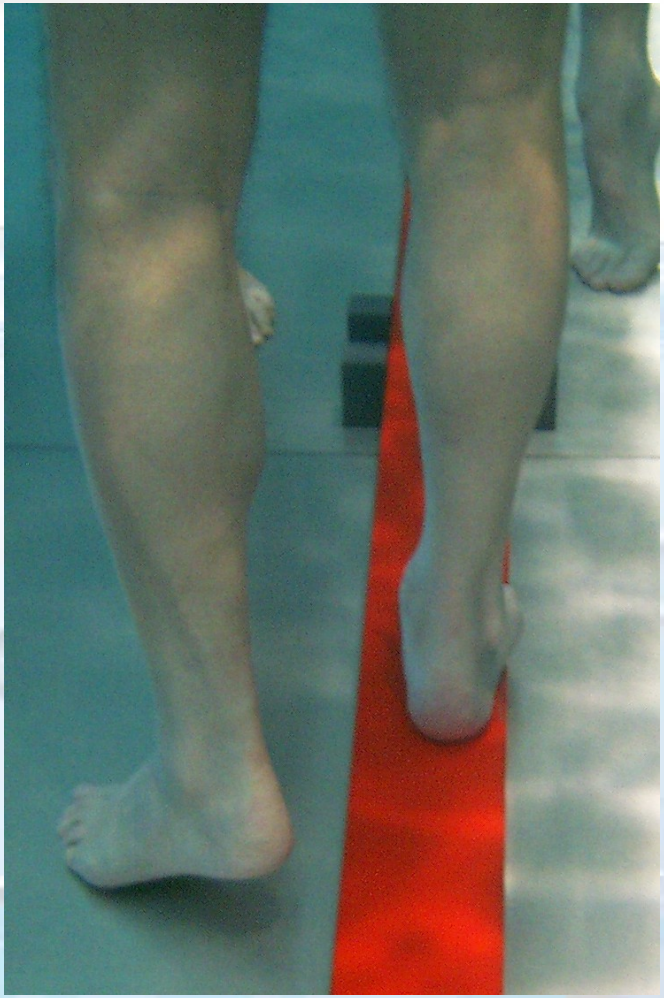


The effect of balance control and vestibular function by an aquatic rotation control and the obstacle avoidance underwater with hemiplegia

HM Kwon, 2009

Figure 38. Obstacle course on balance board

Figure 39. Obstacle course on hurdle

Figure 40. Obstacle course on balance beam with task-orientation

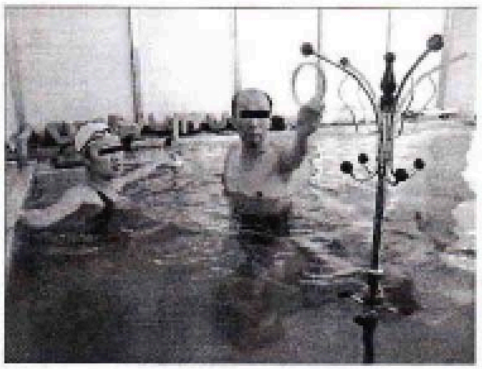
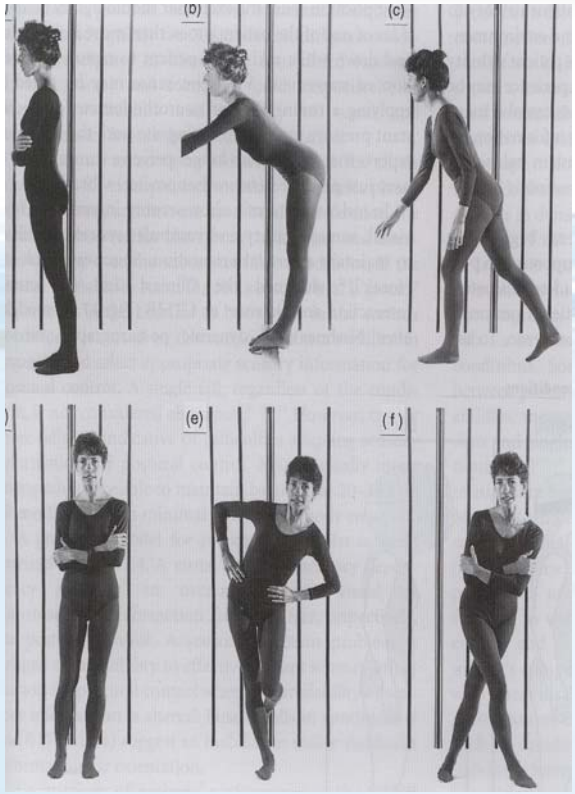


Figure 41. Obstacle course on adjustable reaching pole

Static balance

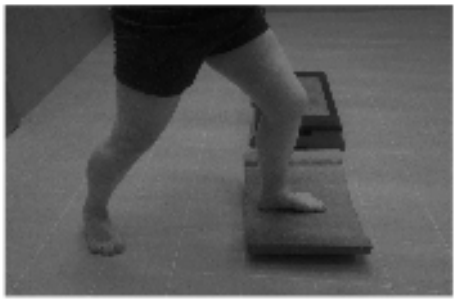


- Hip- / stumble strategy
  - Bronstein 2004
- COG displaces more in water than on land and also faster > probably because of increased hip movements
  - Louder 2014

Stroke: obstacle course

Standing	Improve postural control in standing	Standing with constrained base of support, with feet in parallel and tandem conditions	Narrow base of support Stand on foam Eyes closed Turning upper body Cross arms Stand on one leg	Dean et al., 2000; Pang et al., 2005; Marigold et al., 2006; English et al., 2007; Mudge et al., 2007
		Reach for objects, including down to the floor. Trace spiral on a whiteboard	Practice in pairs by passing objects Constrain and narrow base of support (eg stand with feet together, or in tandem)	Dean et al., 2000; Yang et al., 2006; English et al., 2007; van de Port et al., 2009; Marsden et al., 2010

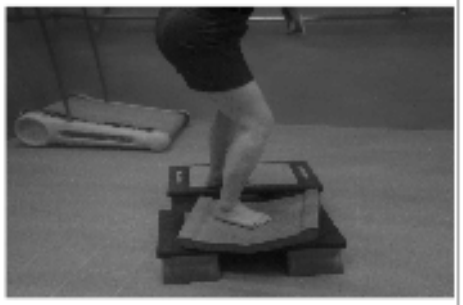
English et al (2012) literature review



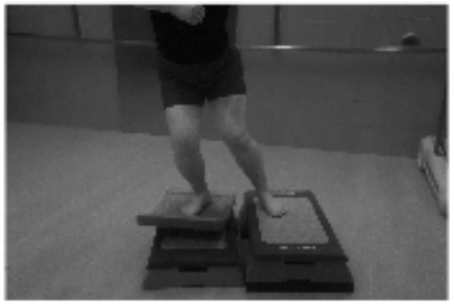
One legged knee flexion
양발을 앞뒤로 벌려 한발은 바닥, 다른 발은 원더보드 위에 서서 몸을 앞으로 밀면서 무릎 구부렸다 펴기

Toe stand
원더보드 위에서 발을 양쪽으로 편안하게 벌리고 서서 발뒤꿈치를 올리고 내리는 동작 반복

One legged stance
원더보드 위에 한발 서기



Both legged knee flexion
발을 양쪽으로 벌려 한발은 수중스텝, 다른 발은 원더보드 위에 서서 양쪽 무릎 구부렸다 펴기



Weight shift
발을 양쪽으로 벌려 한발은 수중스텝, 다른 발은 원더보드 위에 서서 좌우로 골반이동

Fig. 2. Methods of aqua exercise program

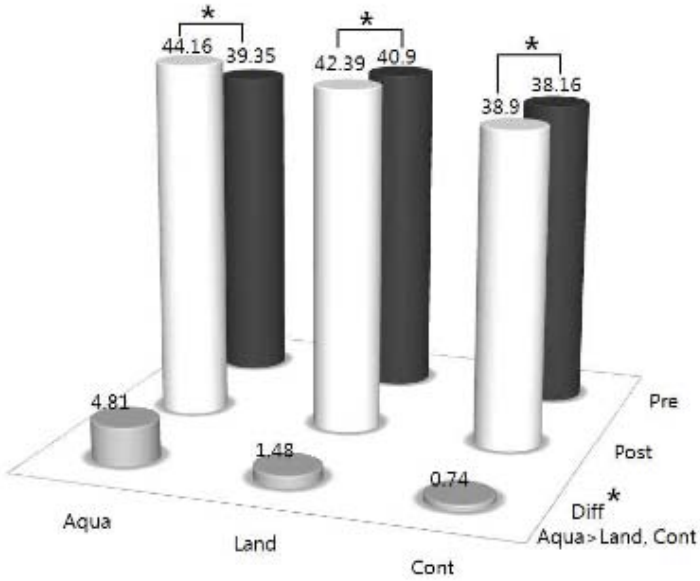


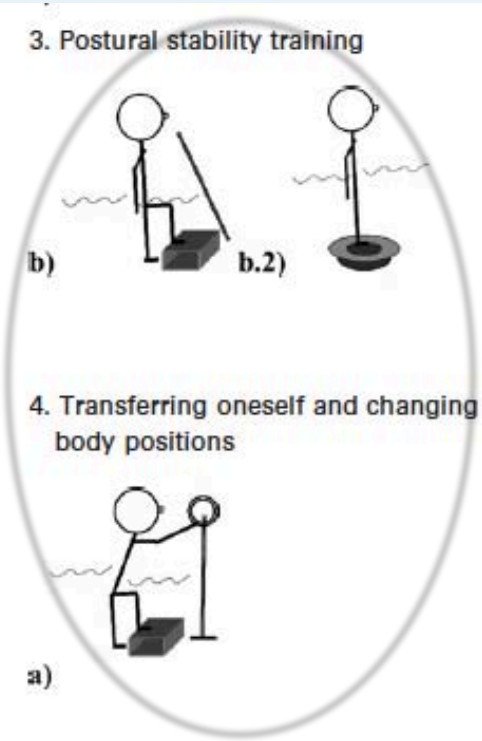
Fig. 17. A comparison of BBS between pre-post(*p<.05)

Han et al 2012
Proprioceptive exercises in water and on land N = 93, RCT, chronic stroke

All groups showed increase of COG sway, with only water giving a ss difference

BBS changed most in the water group

	% change T_0-T_1	%change T_0-T_2	ES T_0-T_1
BBS land	4	4	0.42
BBS water	14 (7 points)	9	



Vivas J 2011. Parkinson and AT (Halliwick)

RCT, n = 11, H&Y 2/3,
Therapy during On phases
Control: land ex, matching AT in terms of exercise characteristics

Assessment: T_0 – T_1 (4 wk) – T_3 (17 days after T_1) in Off dose
BBS and UPDRS (unified PD rating scale): ss changes and a moderate effect size

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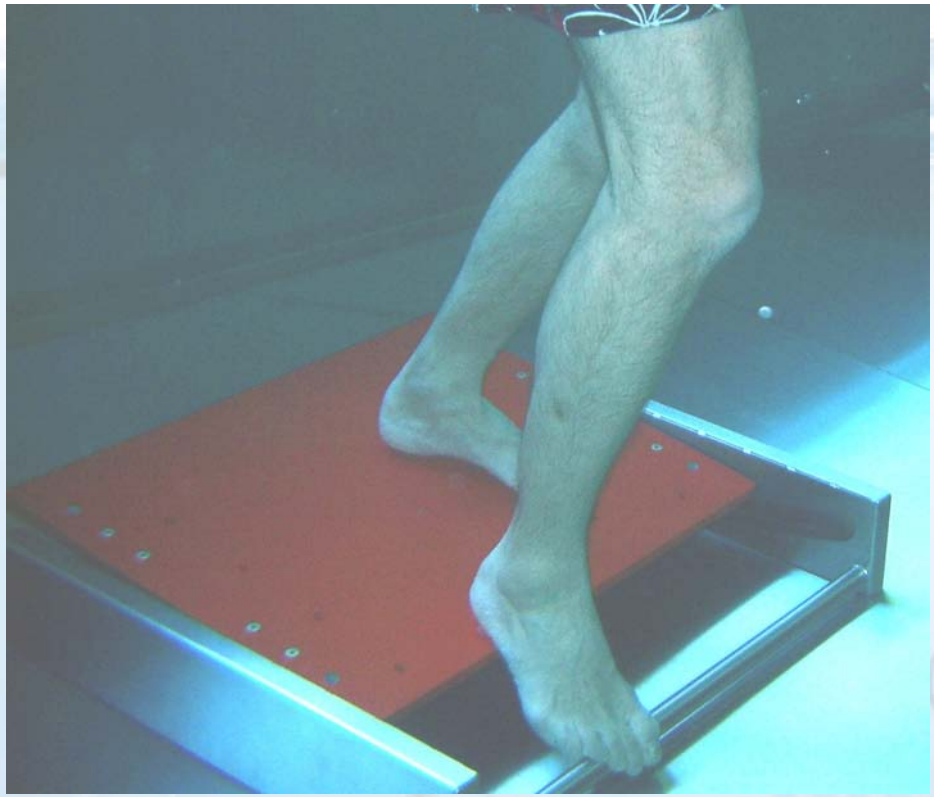

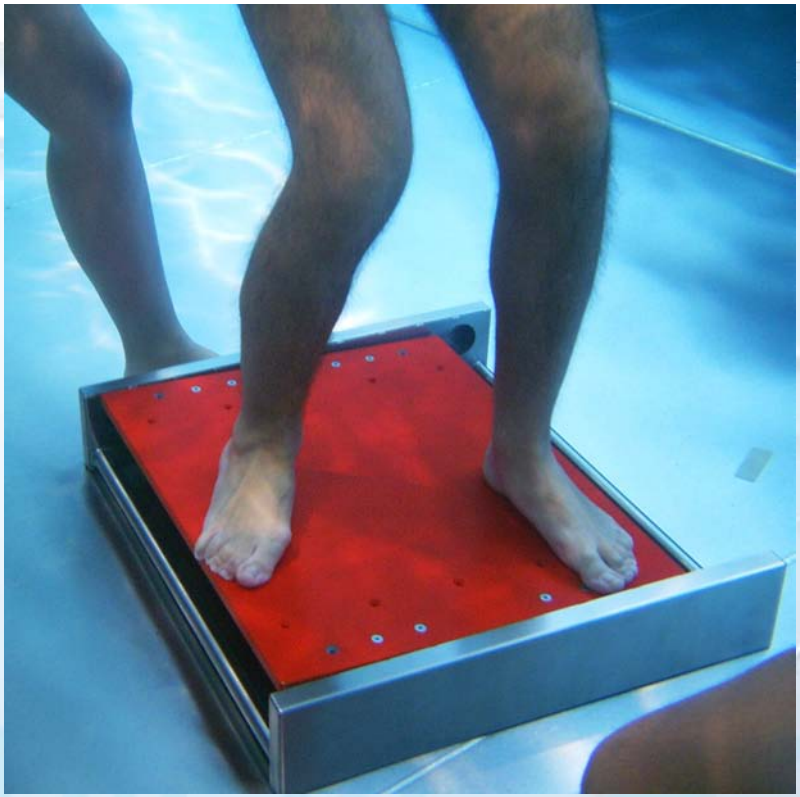

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Thank you and let‘s go the pool

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References at request