Gait Training to Improve Balance?

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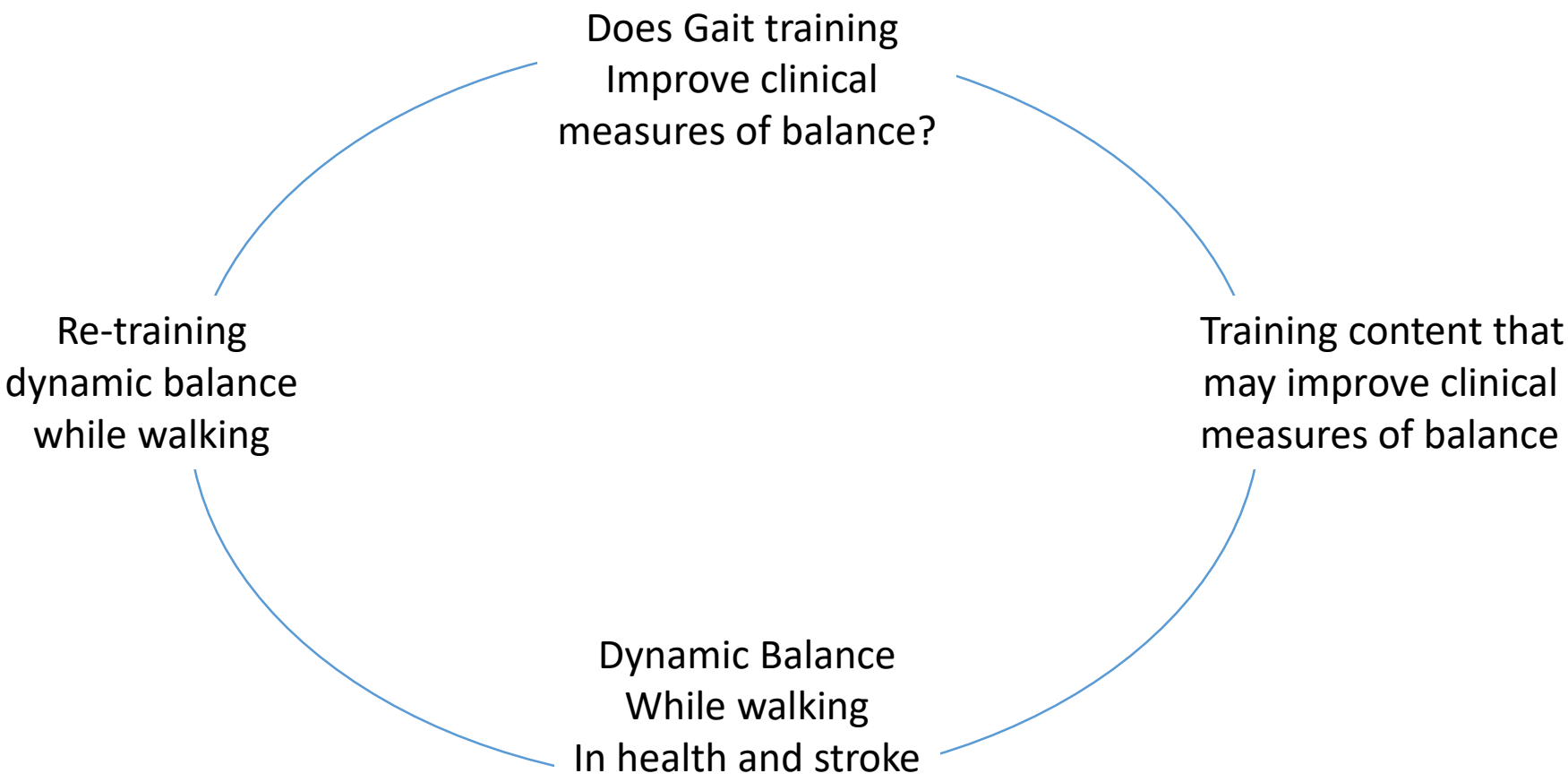
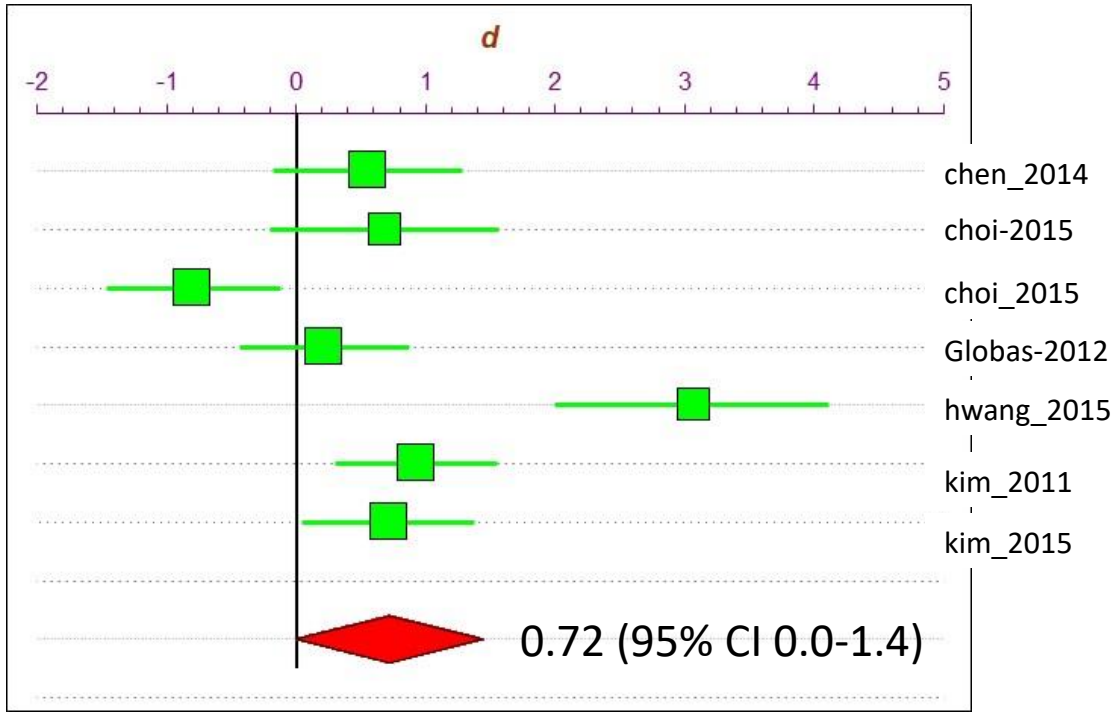
RESEARCH WITH PLYMOUTH UNIVERSITY


Does Gait training
Improve clinical
measures of balance?
Training content that
may improve clinical
measures of balance
Dynamic Balance
While walking
In health and stroke
Re-training
dynamic balance
while walking

Does Gait training Improve Clinical Measures of Balance?

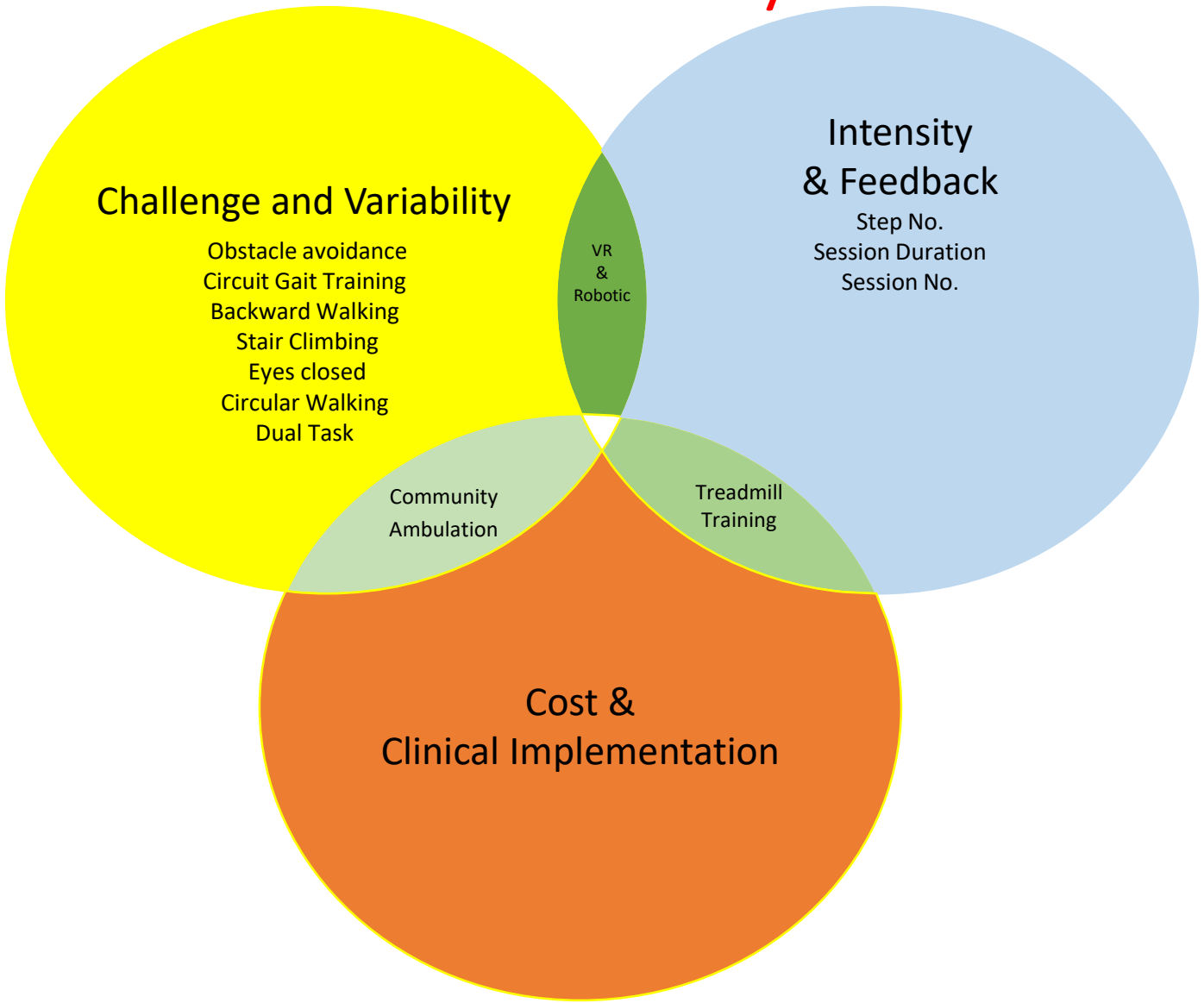
Treadmill Training (+ adjunct) Vs conventional therapy or treadmill training alone

- 8 articles with 275 people
- Duration 4-12 weeks
- Frequency 2-4 x/week
- Sessions 15-30 minutes
- Pedro 6.5/11 (IQR 2)



Tally et al (2017) Topic Stroke Rehabil 24(7) 539-546

Training Content that may influence Balance Recovery



Clinical Measures of Balance

- Berg Balance scale
- Dynamic Gait Index
- Timed Up and Go

- Mini Best Test
- Trunk Impairment scale

- Postural Sway
- Limits of stability

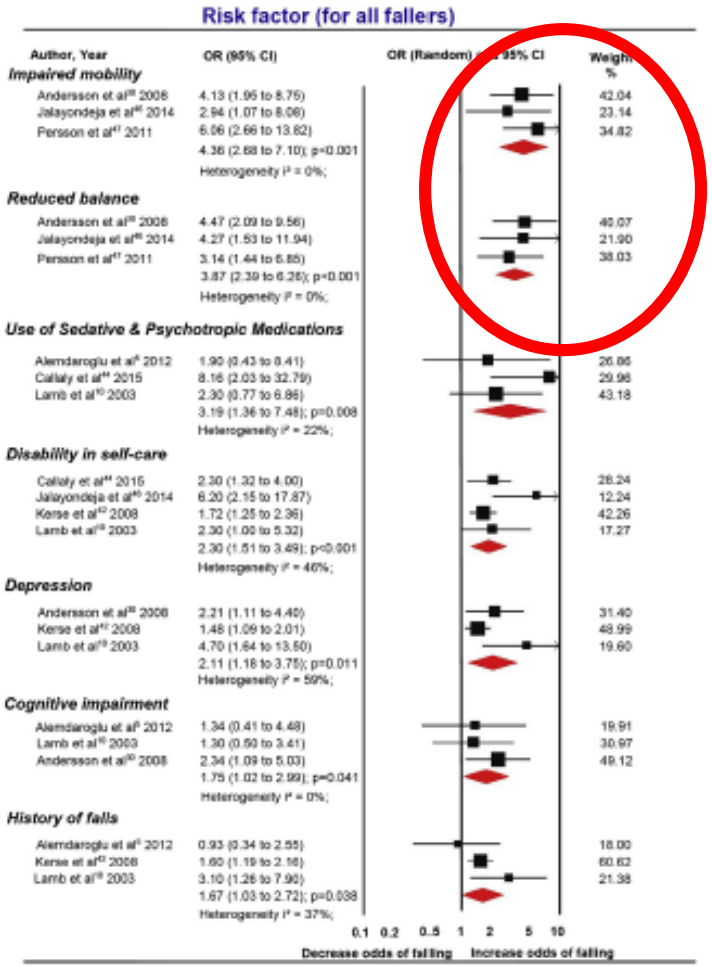
- Reliable
- Responsive
- Able to predict :

Community ambulation
Ability to increase walking speed
Falls

Mansfiled et a; 2015 Physiotherapy 101 373-380
Middleton et al 2017 Disabil Rehabil 39(5) 497-502
Madhavan et al Top Stroke Rehabil 24(8) 579-584

Balance, Falls and Falls Risk

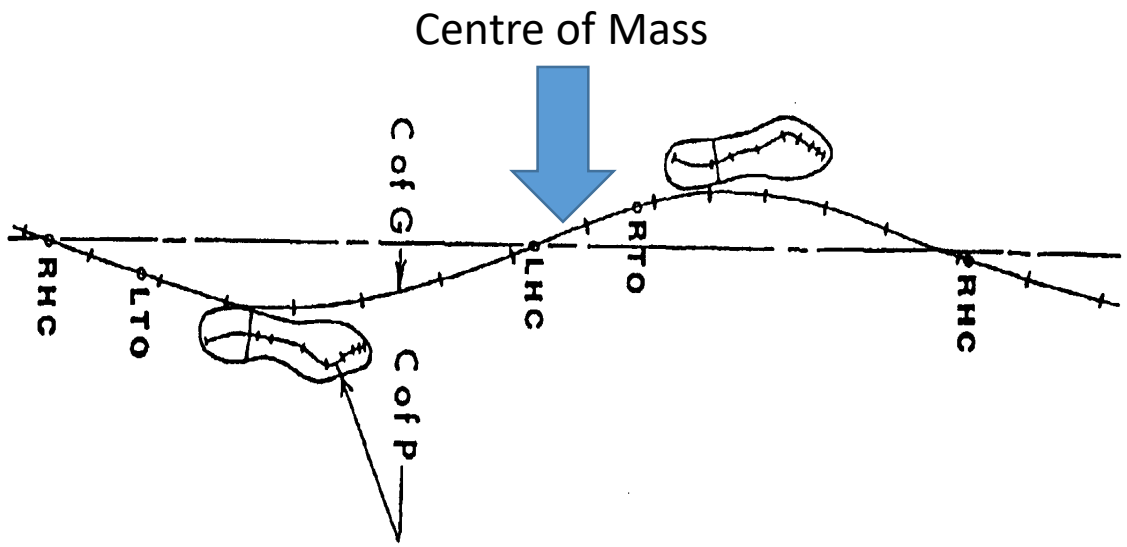
Walking and Transfers are the most commonly reported activity associated with a fall



Mobility and Balance are the Highest predictors of falls post stroke

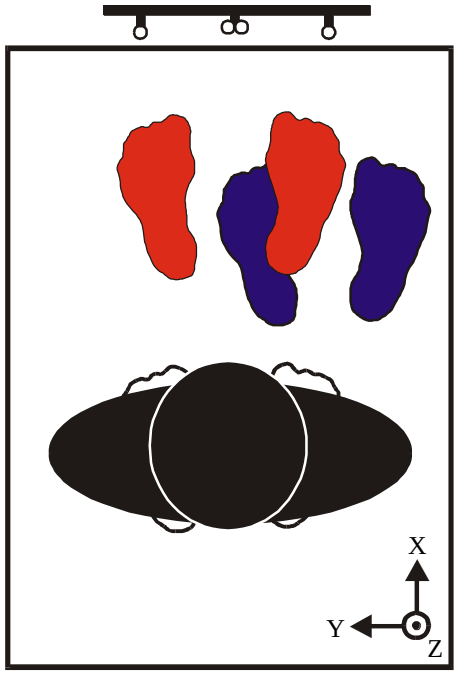
Xu et al 2018 APMR 99 563-573

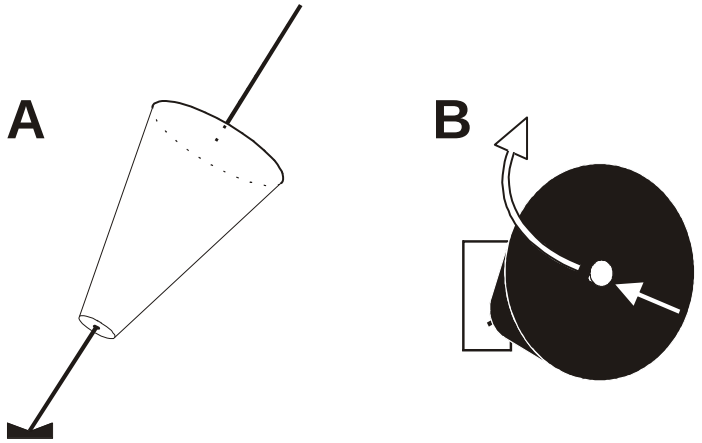
Dynamic Balance while Walking and Stepping



Winter et al, 1995 Gait and posture

Dynamic Balance while Walking and Stepping
A throw and catch





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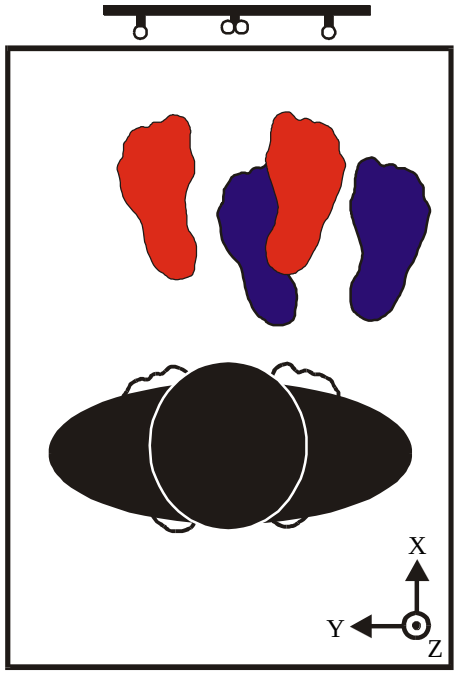
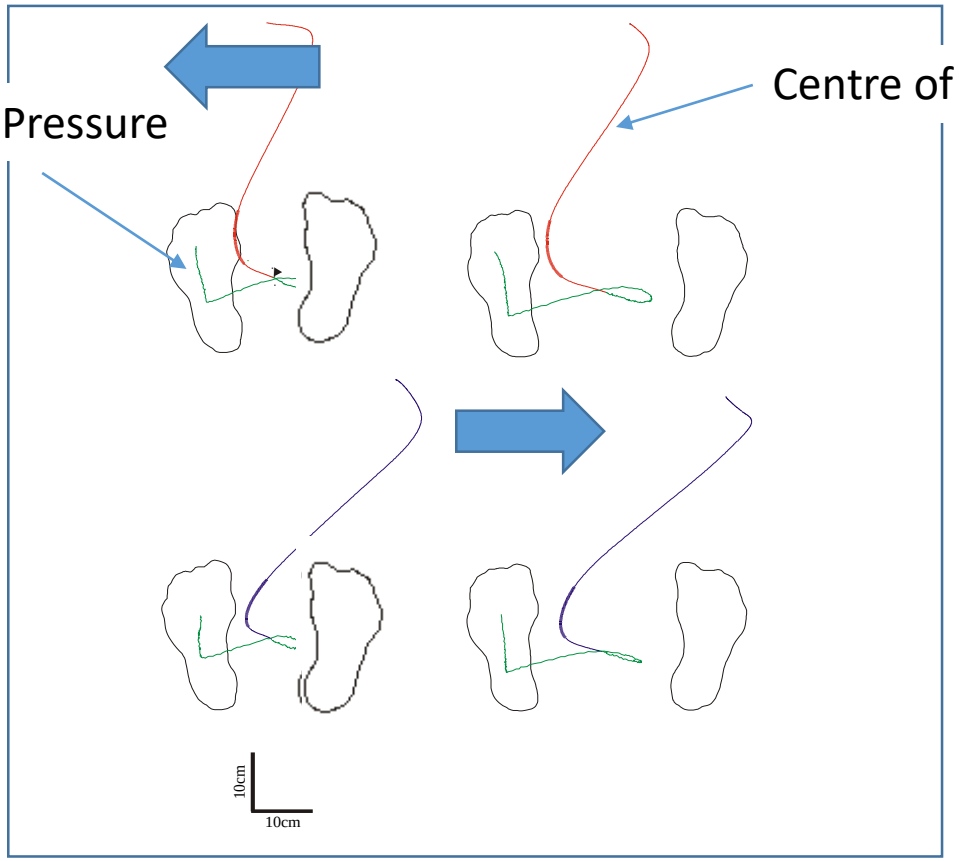
.The starting position and velocity of the cone is set to the position and velocity of the subject's CoM at toe-off. Thereafter the cone falls freely under the influence of gravity.

Stability depends on the position AND velocity of the centre of mass

Lyon and Day 1997 Exp Brain Res 115 345-356

Dynamic Balance while Walking and Stepping
A throw and catch





Stability depends on the position AND velocity of the centre of mass

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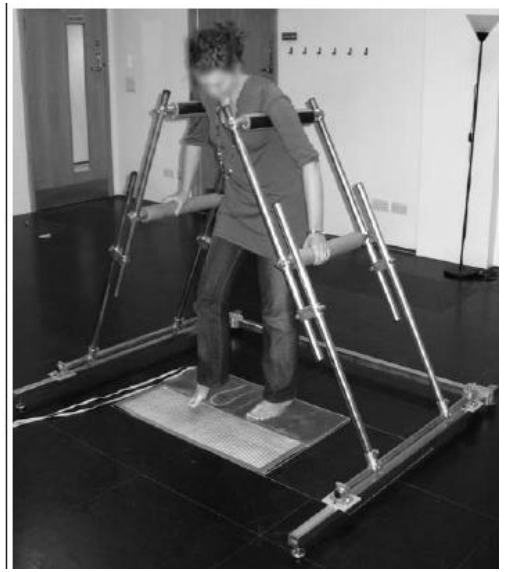
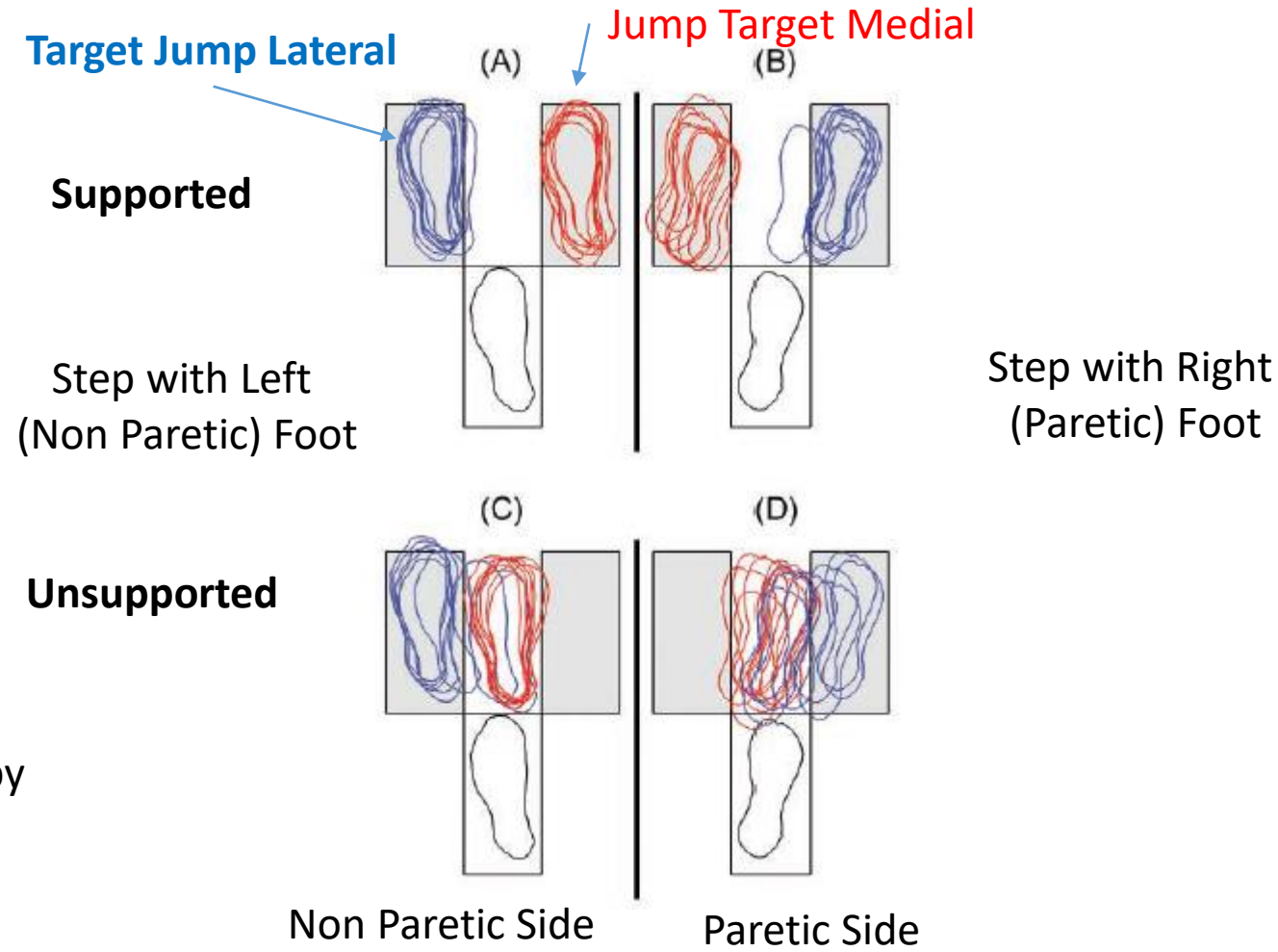
Difficulties with co-ordinating the throw and catch after stroke

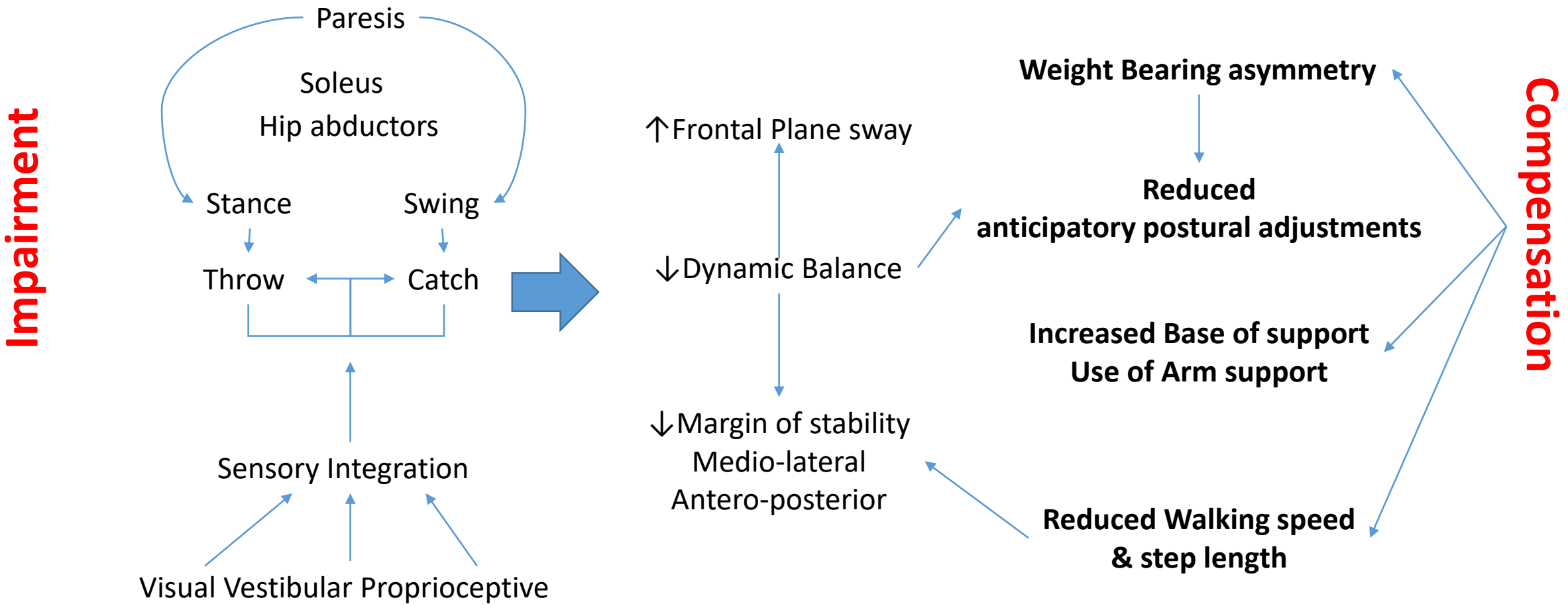




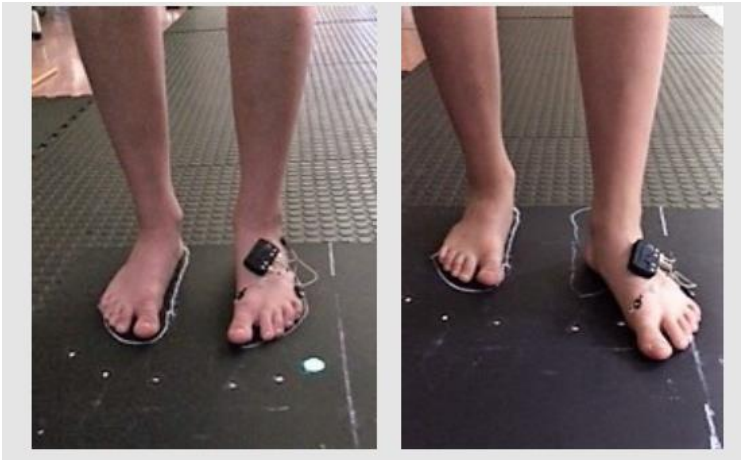
Poor medial foot placement may be caused by Inability to adjust the medial motion of the Centre of Mass

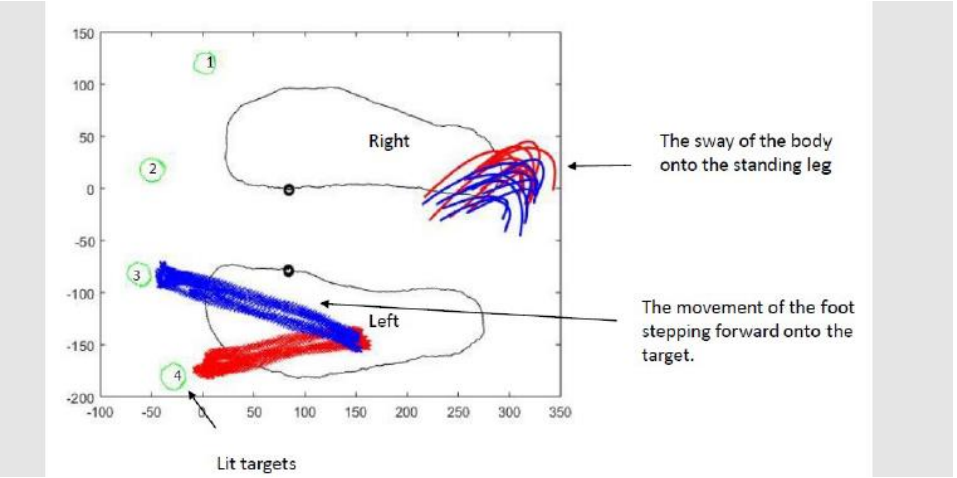
Nonnekes et al 2010 Neurorehabil and Neural Repair 24(4) 393-400

Causes of dynamic balance and walking deficits: Compensations Vs Impairment



Measuring and Retraining dynamic balance while walking and stepping after a stroke?





Frontal Plane angular momentum α Dynamic gait Index (r=-0.57) and BBS (-0.54)

Trunk Acceleration α Timed Up and Go and BBS

Vistamehr et al 2016 J Biomech 49(3) 396-400

Measuring and Retraining dynamic balance while walking and stepping after a stroke?

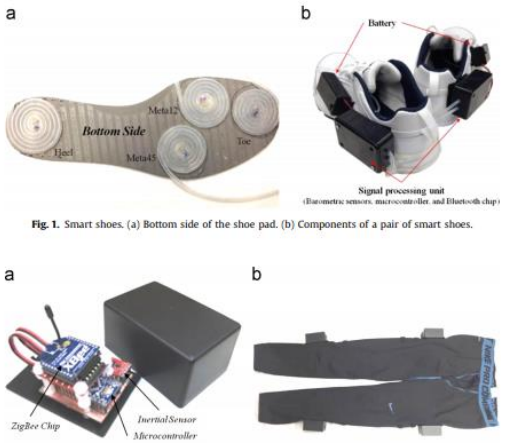
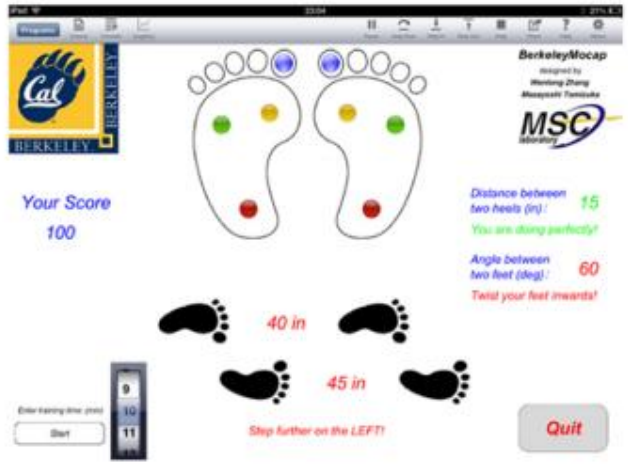


Fig. 1. Smart shoes. (a) Bottom side of the shoe pad. (b) Components of a pair of smart shoes.

Byl et al Neuropsychologia 2015 79 332-343

Wearable sensor technology (e.g. velocity, acceleration)



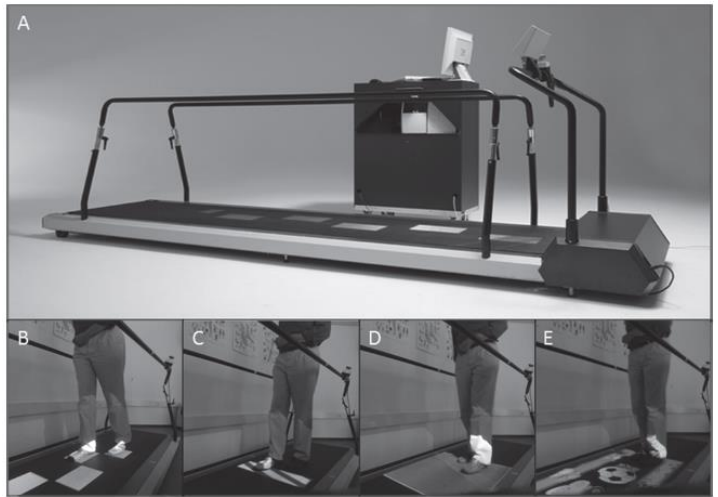
Measuring and Retraining dynamic balance while walking and stepping after a stroke?

Impairment Based?

- Soleus
- Swing leg Hip Abductors
- Stance leg Hip Abductors

- Sensation and

Sensory integration (visual, proprioceptive, vestibular)



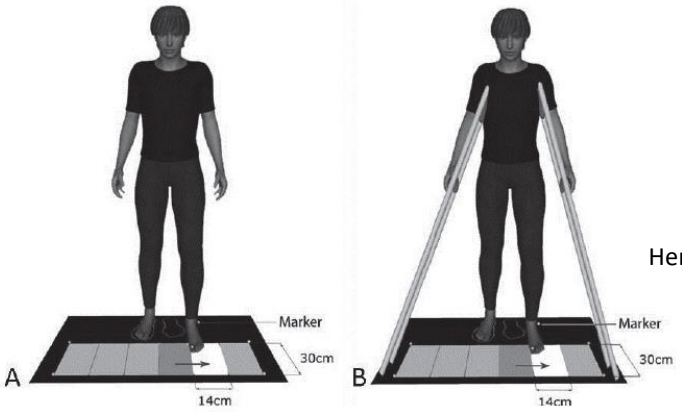
Task Related Training?

- Obstacle avoidance
- Visually guided stepping
- Speeding up / slowing down
- Vary BOS
- Perturbation- based balance training
- Split belt training

Mieville et al 2018 J Electromyog Kinesiol 41-49

- Encouraging symmetrical weight bearing

Kam et al Gait and posture 53 5-10



Herren et al J Rehabil med 2013 45 616-622

Summary

- Gait training can improve clinical measures of balance
- Increased challenge and intensity of training may be associated with greater effects
- Dynamic balance during walking is affected post stroke
- More research is required to determine whether dynamic balance can be re-trained post-stroke

Acknowledgements

- Prof Brian Day UCL

- Rachel Rapson NIHR fellow UoP