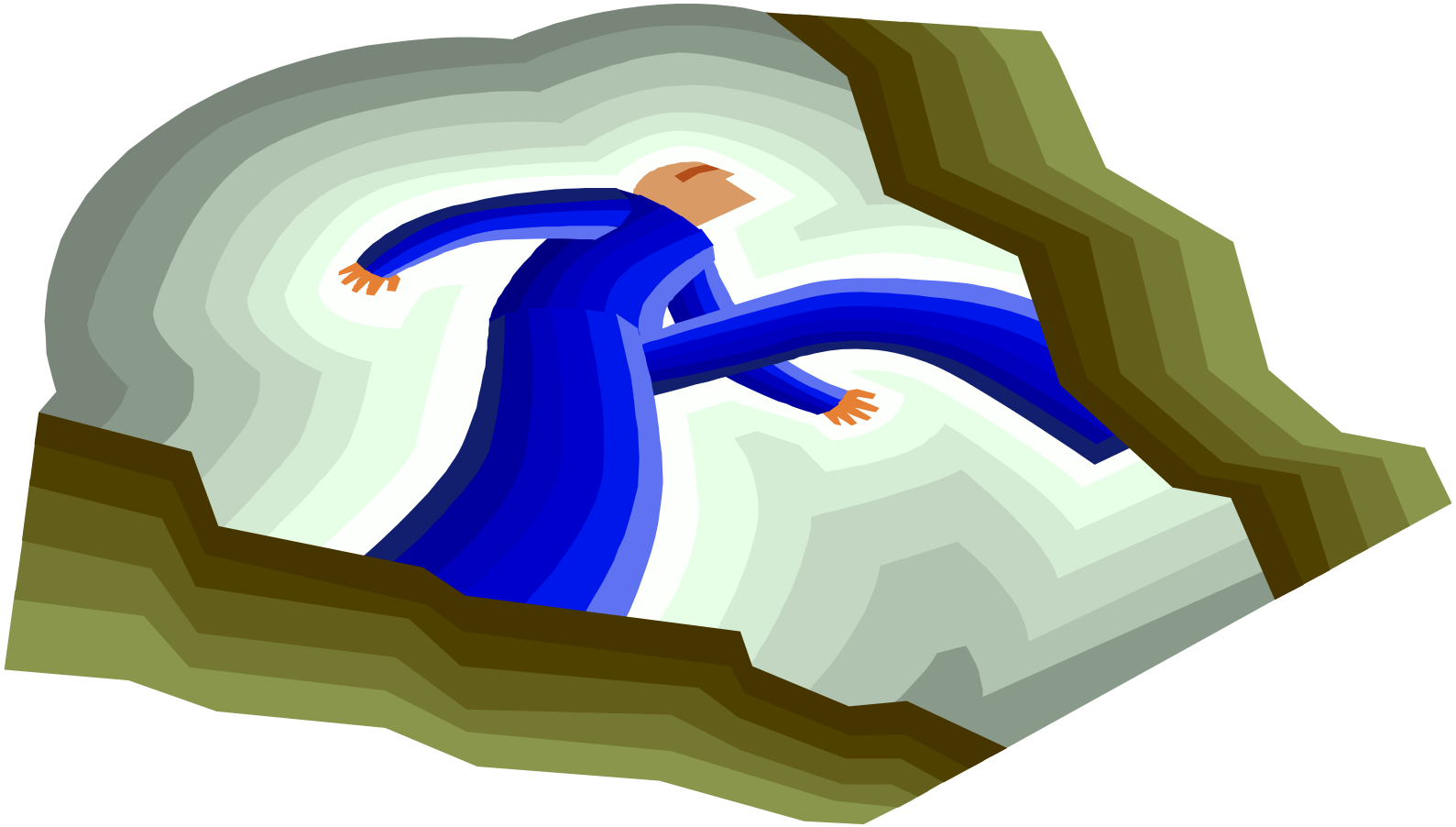
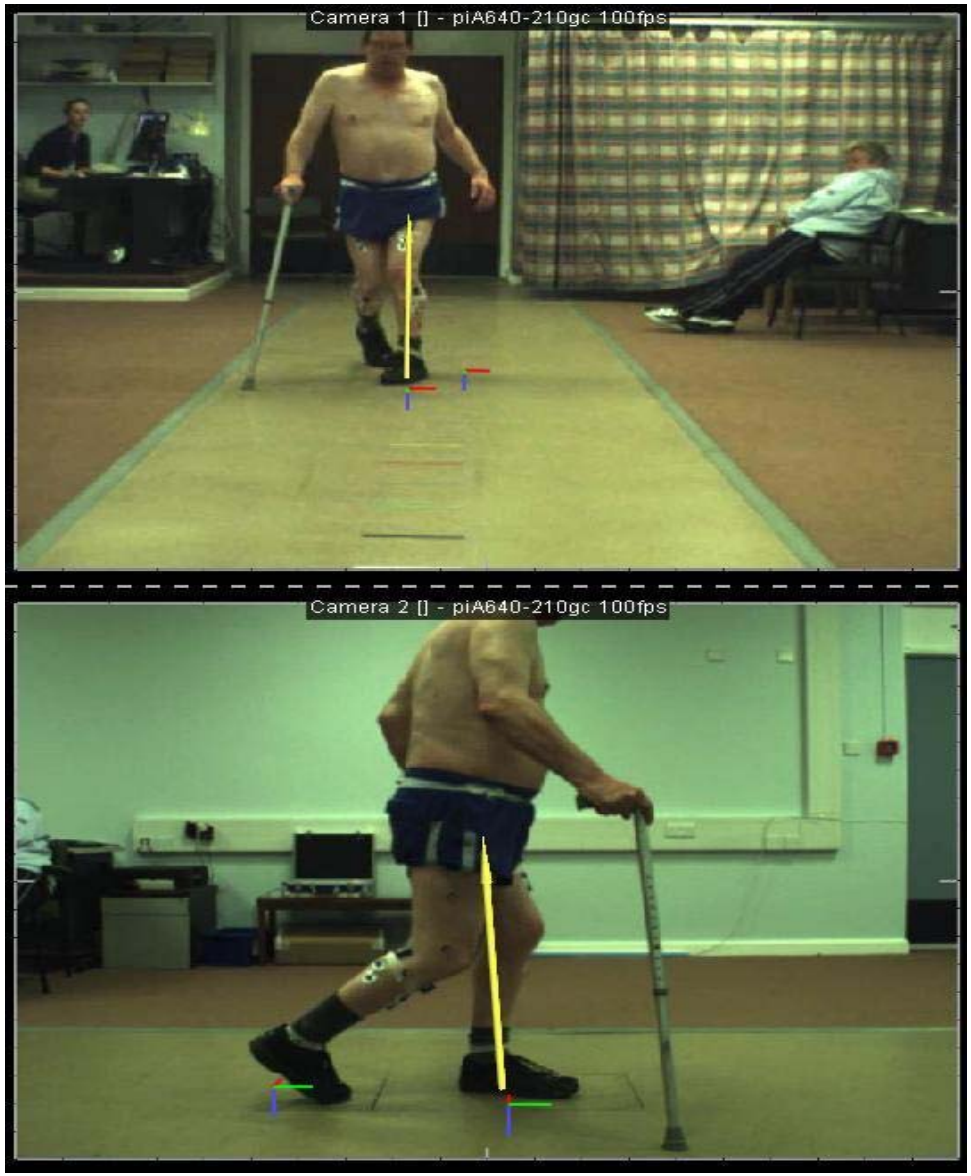
Spasticity in gait



Clinicians recognise spasticity but the elements of spasticity contributing to gait patterns are often difficult to identify:

- Variability of muscle tone
- Observation/recording
- General measurement of gait

Ground Reaction Vector



Common compensations

Compensations are usually strategies to keep the CoG within the base or conserve energy.

The closer the GRV to the joint centres/lower the forces the less muscle activity and range of movement required.

Vertical displacement

Short step

Slower walking

Increased step width

Weight transfer

Longer period of double support

‘Normal’ values

Speed 1.5 m/s

Stride 1.5m

Cadence 115 steps/min

Affected by many factors including

- Environment/surface
- Anthropometric data
- Increased muscle tone/spasms/weakness/soft tissue dysfunction
- Mood/motivation

- Markers for age related changes:

Speed reduces by ~15% per decade after 65/70 years

Increased stance time, double support and step width

Shorter stride

- Markers for non-age related gait deterioration:

Reduced stride/speed/contralateral step length

Methods of Gait Analysis

- No specific measurements of spasticity in gait
- WHO classification talks about people moving around in their environments
- Are you measuring parameters for clinical outcomes, items important to the patient or functional activity?

Methods

- 3-D motion analysis
- Timed walk
- Observational analysis/Video
- Electronic walkway e.g Gaitrite
- Endurance testing
- Energy expenditure
- Data Logger
- Functional scales

3-D Instrumented analysis

- Validity and reliability good but dependant on clinical set up.
- Kinetics/ kinematics/spatio-temporal data/ EMG/video
- ‘Real time’ and recorded
- Identify and interpret more than visual analysis

Timed Walk

- Speed related to reduced falls/increased LL muscle activity and performance/ less requirement for assistance
- Protocol improves validity and reliability
- Varying distances and procedures reported.
- Ability to vary speed is important indicator of gait recovery in BI
- Speed is not always most important.
- Significance depends on original speed

Endurance/Energy expenditure

- Endurance tests are shown to be reliable but there is little information on the clinical relevance of this test in people with spasticity.
- O2 consumption using
- PCI: requirements for steady state often make it impractical for this group.
- Data logger

Functional scales

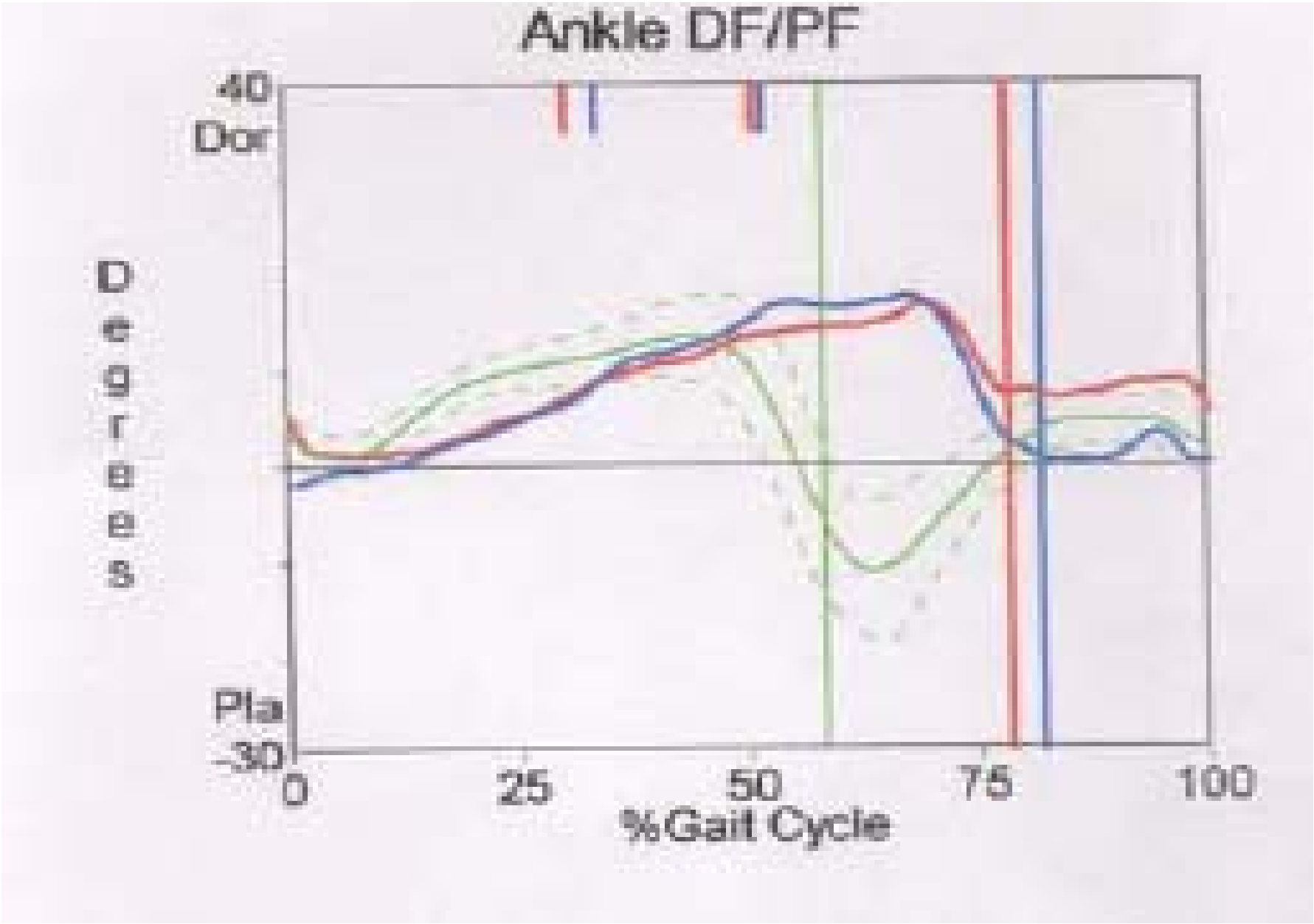
- Numerous
- Benefit of ordinal scales?
- Responsiveness
- Rivermead Mobility index responsive/ well used/ based on good psychometric properties

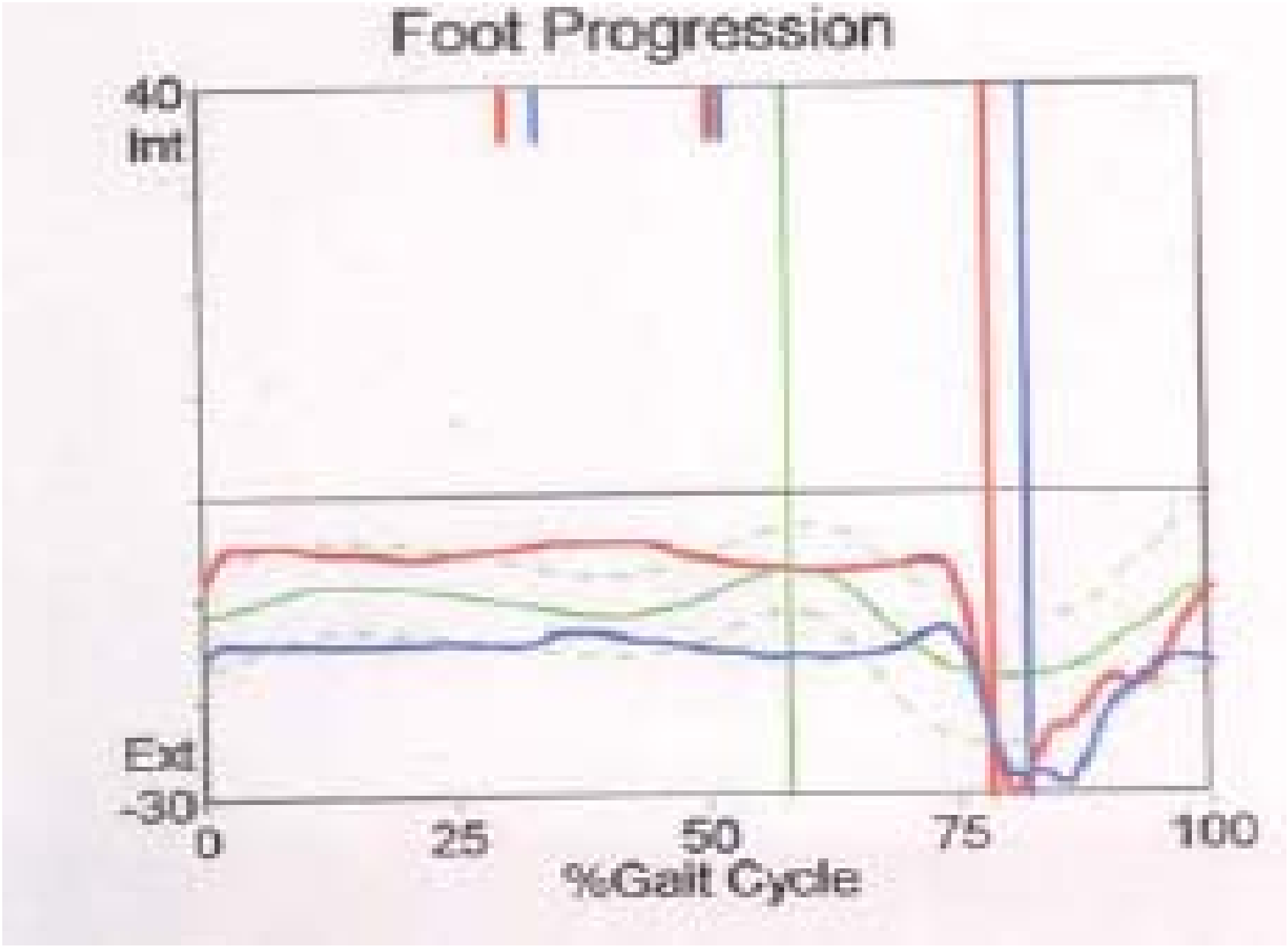
Essentials for gait

- Forward momentum requires
  - hip extension
  - ankle plantar flexion
  - kinetic energy from the swing phase of the contralateral limb.
- Tibial progression
- Foot clearance
- Loading response

Case study 1

- 51 year old with hereditary spastic paraparesis
- Falls and stumbles even with bilateral AFOs on
- Bilateral lower limb spasticity → difficulty advancing both legs and lifting feet
- Effortful walking, especially downward inclines and uneven ground

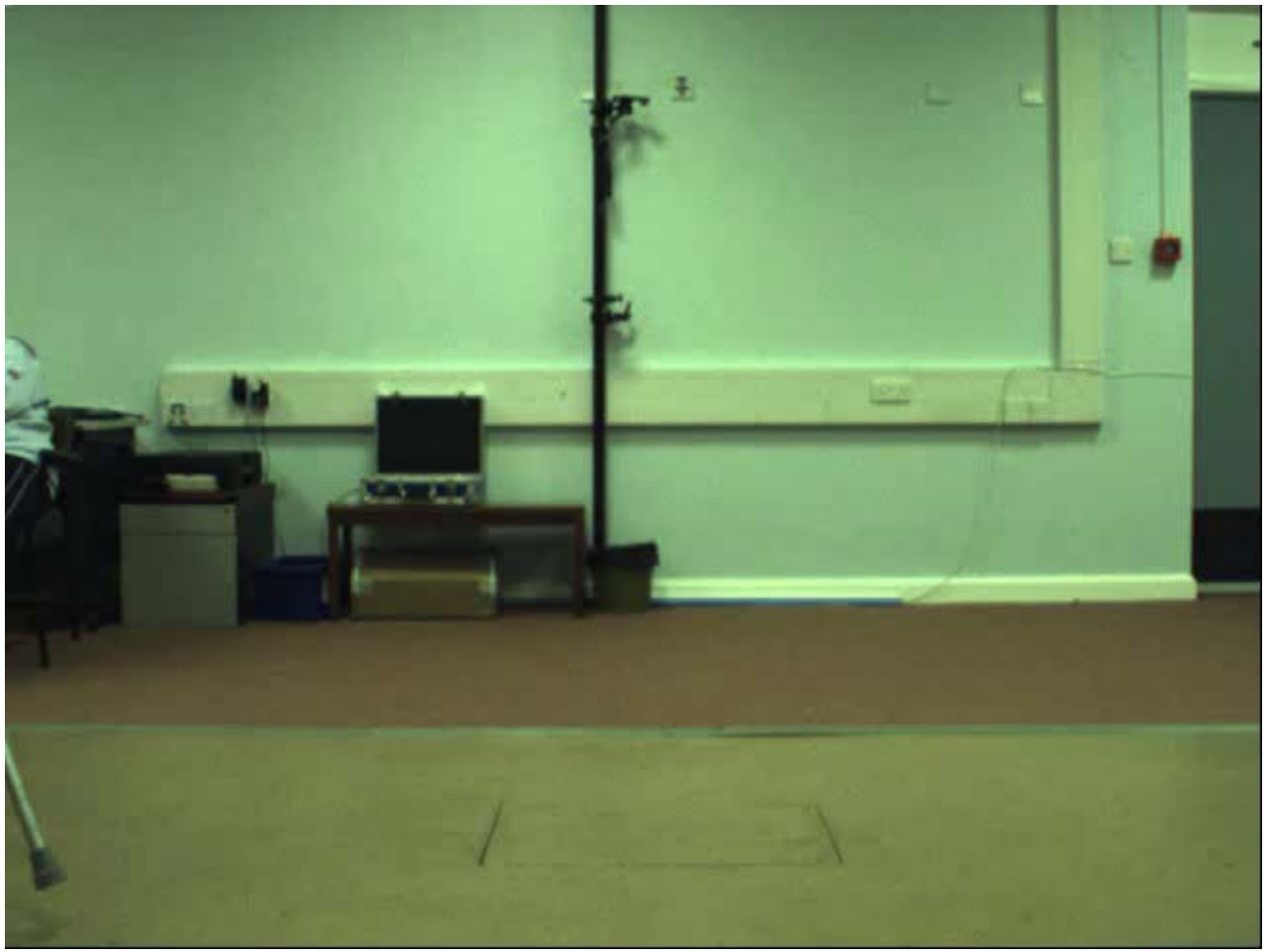



Foot Progression
40
Int
Ext
-30
0
25
50
75
100
%Gait Cycle

Case Study 2

56 year old gentleman with cerebral palsy

- Posterior knee pain and tightness increasing on downward slopes, walking and exercising.
- Falls several times a week/stumbles many times daily
- Poor confidence and effortful walking

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Camera 2 [] - piA640-210gc 100fps

- Utilise a range of assessment and evaluation measures to construct a full picture.

- Always interpret in a clinical context and use clinical expertise.