Gait Analysis 2007

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Opportunity for excellence

Gait Analysis

overground / treadmill

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Gait analysis

Outline

- why ?
- effect of treadmills
- reliability
- things to look for
- Lead up to practical sessions in clinical biomechanics…
- Bring together info from previous lectures

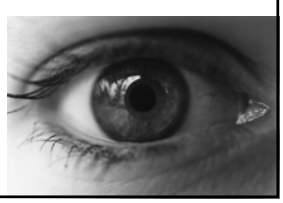
Gait analysis

- static measurements may be invalid indicators of dynamic function
  - 'the only way to assess a dynamic structure is dynamically'

    (Knutzen and Price, 1994; McPoil and Cornwall, 1994)
- can be used:
  - prior to static assessment to 'focus' on particular areas of interest
  - after static assessment to confirm findings
- points to consider
  - requires a lot of practice
  - movements take place in a fraction of a second

Gait analysis - how

- systematic approach
  - head to toe
  - check for asymmetries
  - if using a treadmill, also check sagittal plane - although you still can view the SP in overground locomotion
  - **see handout in manual**



Upper Body

- Head tilt (FP) - LLD?
- Head rotation (TP)
- Shoulder drop (FP) - LLD / dominant side position?
- Height of hands
- Asymmetrical arm swing
- Pelvic drop (FP) - LLD / weak hip abd?

Legs

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- Frontal plane knee posn. - g.varum/valgum
- Frontal plane tibial posn - tibial varum/valgum
- XS internal knee rotation (TP) - int. genicular posn.
- internal knee posn - int. fem. torsion/version
- knee flexion/extension (SP) - g. recurv./flexed knees.
- tibial rotation (TP) - timing of STJ pronation/re-supination

Foot & Ankle

- Bouncy gait - AJ equinus
- Early HL - AJ equinus
- RF posn. at HS, FFL, MS, HO - XS STJ pronation/supination
- arch height (SP) - ...
- Helbing's sign (lat. bowing of TA) - XS STJ pronation
- Navicular drop (SP) 1-2cm - no index though
- Abductory twist

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Foot & Ankle...

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- Clawing of lesser digits - flexor stabil.
- Prominent extensor tendons - ext. substitution
- First ray DF/PF (SP) - Hallux rigidus/limitus, Functional HL
- Angle of gait - ext/int limb posn, obesity
- 'Too many toes' sign - XS FF abduction
- FF splay - MTJ hypermobility
- 'Slapping gait' - weakness of extensor muscles
- Supinatory rock - rigid FF valg.

Gait analysis

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- treadmills
  - useful adjunct to overground walking evaluation
  - benefits
    - continuous
    - videotape: replay, frame-by-frame
    - also observe sagittal plane
    - patient education
    - Digital video - advantages? (Discuss SiliconCoach system later)
    - Hz/quality/FbyF

Problems with treadmills

- expense
- safety
  - may not be appropriate for patients with balance difficulties / children

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Problems with treadmills...

- gait alterations
  - inconsistent: may over-predict or under-predict overground walking style
  - flat-footed weight acceptance
  - forward trunk lean
  - medial roll-off, rather than active propulsion through 1st MPJ
  - shorter stride length, higher stride rate

(Nigg et al, 1995)

may not be a valid indicator of normal walking

Reliability

Krebs et al (1985)

- 3 ‘expert’ observers rated videotaped gait kinematics of 15 children with lower limb disabilities
- asked to note significant abnormalities in gait
- total agreement occurred in 2/3 of cases
- convenient, but only moderately reliable technique

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Reliability

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Keenan and Bach (1996)

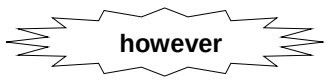
- 4 experienced clinicians assessed videotaped rearfoot function of 24 subjects
- intra-tester reliability was good, inter-tester reliability was poor
- intra-tester reliability improved with experience

Things to look for

- **see handout**
- need to remember normal timing of events
- look for asymmetries / abnormal degrees of motion
- try to concentrate on one aspect at a time
- categorise rather than quantify, and only record if clearly significant
- specific pathomechanical considerations
  - abductory twist
  - extensor substitution
  - flexor stabilisation
  - angle of gait

Summary

- gait analysis is complex, highly subjective and only moderately reliable
  - ‘even the most experienced practitioner will have difficulty avoiding seeing what he wants to see’



- reliability improves with experience
- static measurements alone are poor predictors of dynamic function
- gait analysis is a useful adjunct to clinical measurement

Clinical Biomechanics

- Gait analysis
- Lower limb analysis, including Pedar

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Describe these gait patterns…

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Questions?