‘Smart’ Gait Analysis?

OXFORD BROOKES UNIVERSITY

Utilizing smartphone technology to provide a platform for novel, cheap and easy to use gait analysis

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Summary

- Smartphones can provide in depth gait parameters
- Gait can be used as a disease discriminative function
- Analysis is objective, quick, easy and cheap

Introduction

Problem:

- 23.1% of patients with movement impairment(s) are measured in gait laboratories;
- Reasons (Toro, 2003 & Simon 2004):
  1) Time consuming (>1.5hrs)
  2) Expensive (> $2000 / assessment)
  3) Too Technical

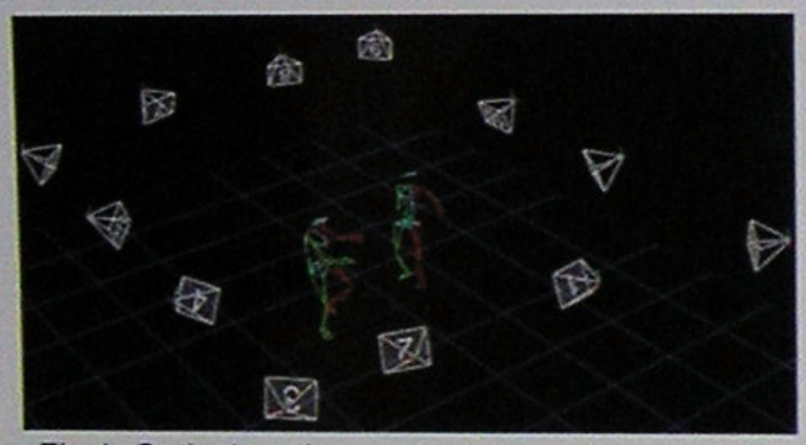


Fig 1: Optical motion capture example

Gait analysis could provide:

- Quick Screen: Could allow pharmacies to quick-screen and re-direct to health care professionals
- Clinical benefit: could direct healthcare professionals towards personalised treatment programs
- Allows certain patient groups self-management of their condition over time

Methodology

- Single sensor approach based on inertial measurement units (commercially available)
- Attached over lower spine with double adhesive tape
- Walking 10metres for accurate readings in a straight line which is a standardised clinical test

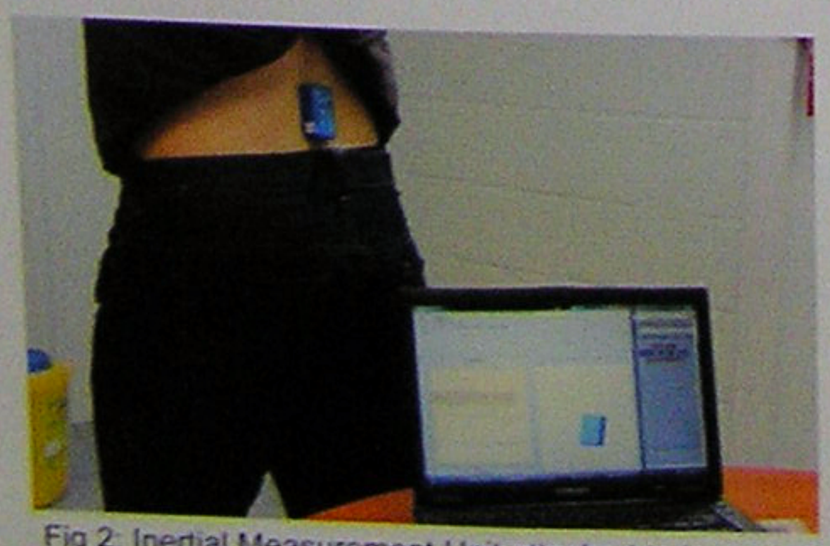


Fig 2: Inertial Measurement Unit attached to lower spine

Results

- Valid & Reliable: Compared to gold standard accurate to within millimetres and reliable over time and between assessors (Esser *et al.*, 2009 / 2011)
- Used in clinical Conditions: Parkinson’s (Esser *et al.*, 2011), Huntington’s (Collett et al., 2014), Stroke (Meester *et.al.*, in press), and many other conditions
- Easy and Quick to use: Untrained, non-technical conditions able to analyse files <1minute after 10 practice rounds.
- Enrolled into large cohort studies: SABRE (n=1700, [redacted]CL), ‘46 Cohort (n=2500, MRC), Discovery PD (n=2000, OUH)
- Outcomes:
  - Temporal (step time & cadence)
  - Spatial (step length, walking speed)
  - Symmetry (left vs right)
  - Balance (single & double stance)
  - Effort (Mechanical Energy, Froude)
  - Disease discriminative algorithms
  - Machine learning and neural network approaches

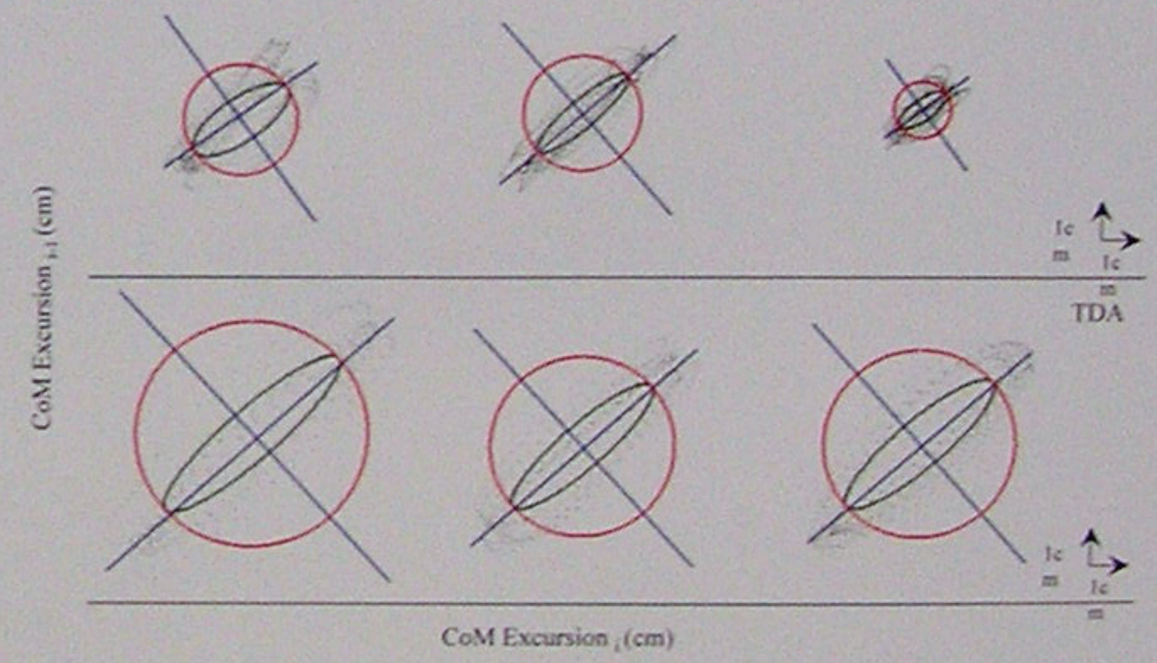
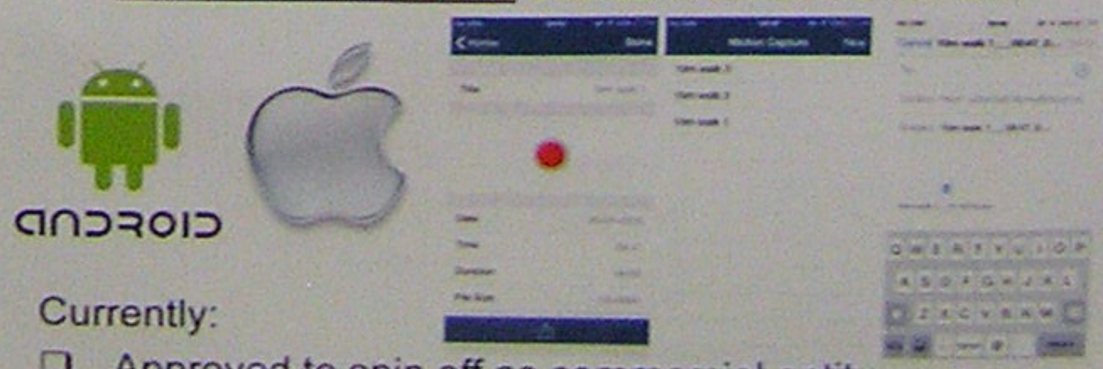


Fig 3: disease descriptive phase plot analysis similarly scaled whereby the top three are typical people with Parkinson’s, and the bottom three are three age matched control participants

Development:

Past:

- ✓ Two patents (Gait Monitor & Gait Asymmetry)
- ✓ Market research completed within clinical sector (2012)
- ✓ Medical Registration as class 1 advice obtained
- ✓ Reference Database >5000 people available
- ✓ Smartphone Platform available for demonstration



Currently:

- ❑ Approved to spin off as commercial entity
- ❑ Fundraising through investment (VC)