New Technology equals more choice and therapeutic opportunities for PwMS?

Two examples of emerging assistive technologies

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2 examples

1. Functional electrical stimulation (FES) for footdrop in MS using a tilt sensor trigger

2. Tremor control for upper limb intention tremor in MS

1. Functional electrical stimulation (FES) for footdrop in MS using a tilt sensor trigger

Footdrop and MS

- MS can present a range of mobility problems including footdrop
- Footdrop corrected to some extent by splinting/ orthotics
- Functional Electrical Stimulation around since 1960s using pressure sensor in heel to trigger ankle lift
- More recently the WalkAide® footdrop stimulator has been developed and is being used in a developing clinical service in Bristol

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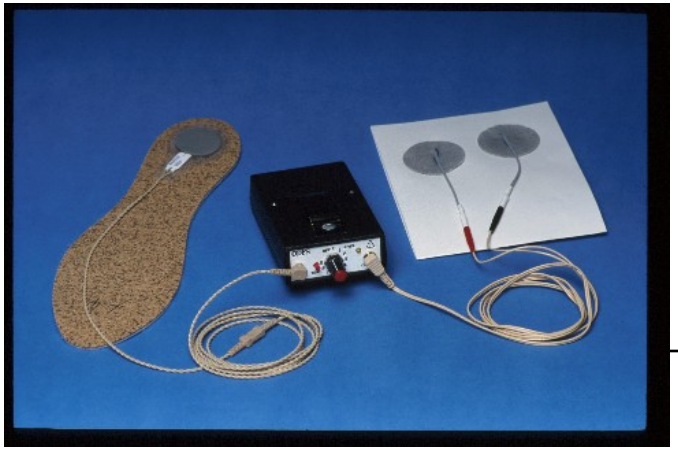
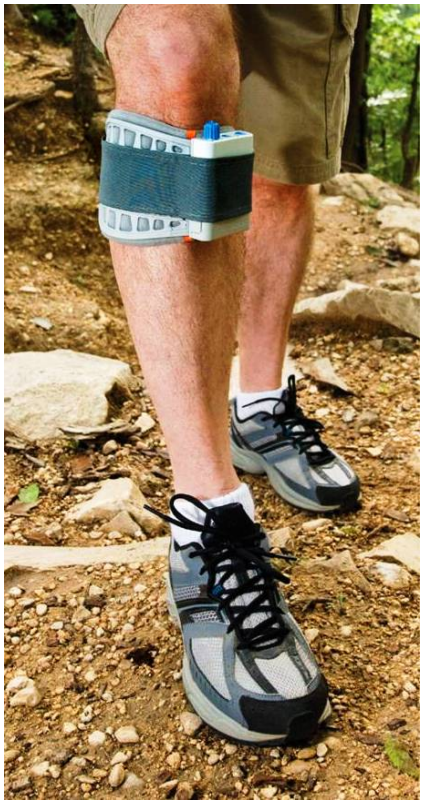


WalkAide® footdrop stimulator

- Does not require a heel insert
- Worn below the knee
- Cuff shaped to the contour of the leg
- Easy to apply



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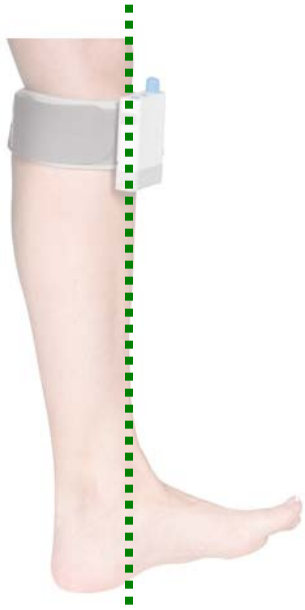
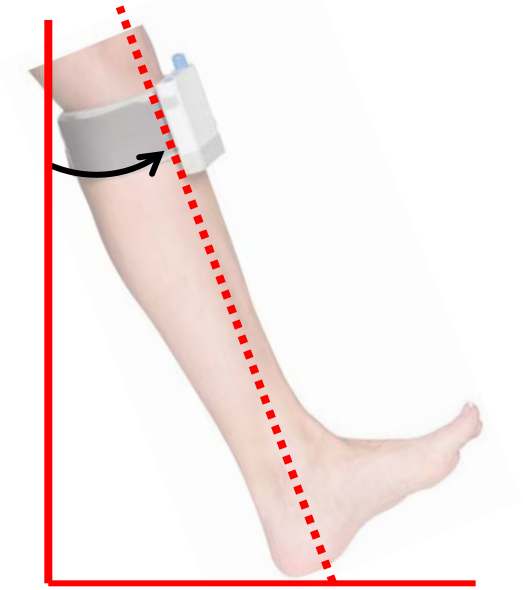
Stimulation triggered by a tilt sensor

Posterior angle: ON



Swing: ON



Anterior angle: OFF

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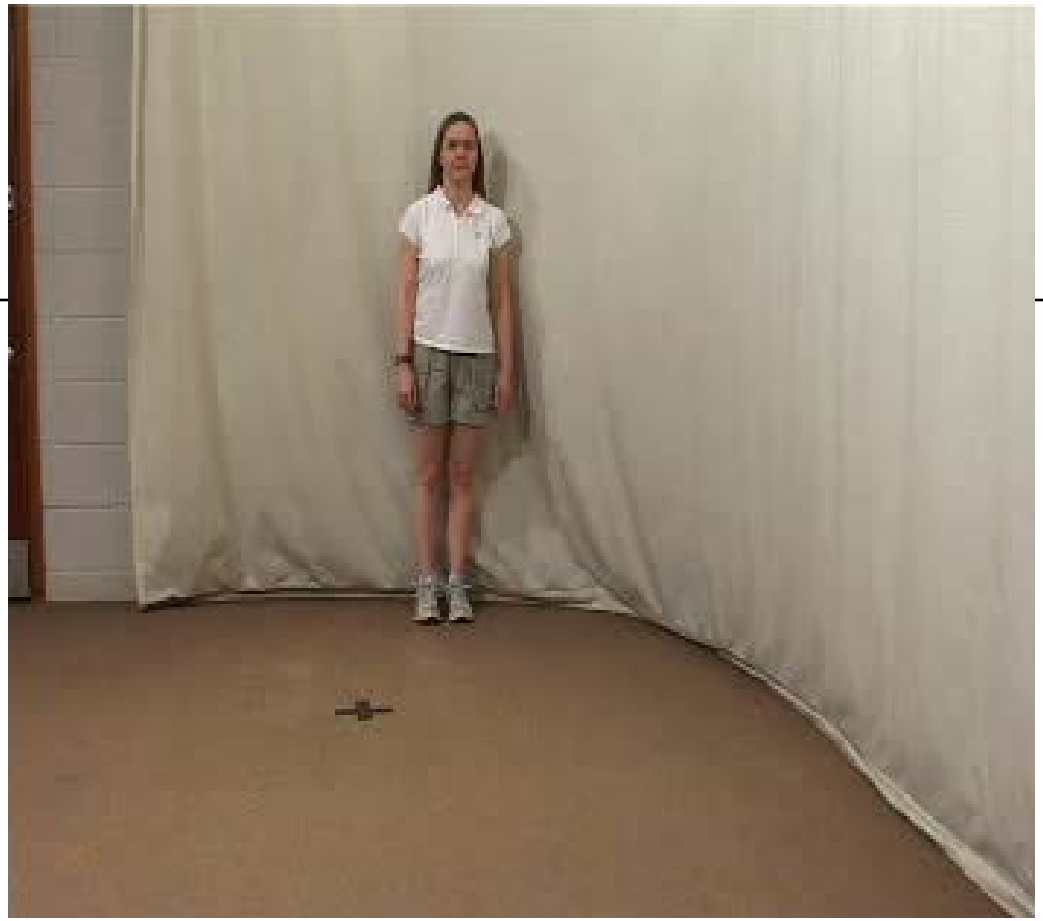

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Clinical service for footdrop

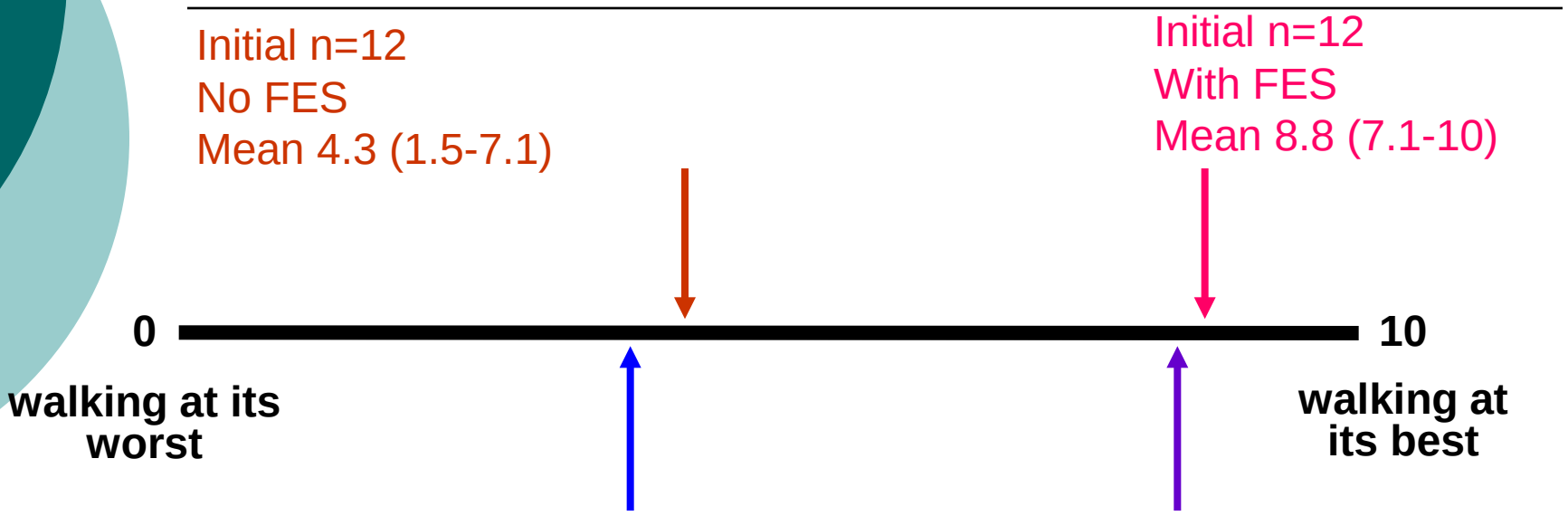
Commenced January 2010

50 people attended for assessment (March 2011)

31 suitable & offered 3 month home trial

Perception of Walking Ability

Visual Analogue Scale (VAS)



9 month follow up n=8
No FES
Mean 3.9 (1.7-5)

9 month follow up n=8
With FES
Mean 8.1 (6.5-10)

Trips & Falls

Initial assessment (pre-FES)

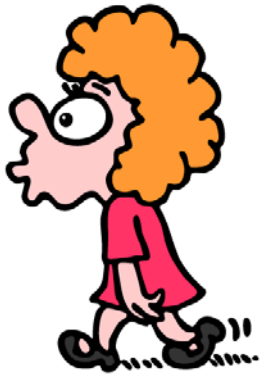
- All reported tripping frequently (daily/weekly)
- 25% reported falls

12 week follow up

✓No trips or falls whilst using FES

✓Reduced number trips & falls when not wearing FES

10 metre timed walk



At 3 months (end of home trial)

Time (seconds)	without FES	with FES
Range	7- 77.2	7.6- 61.8

10 metre timed walk

At 3 months (end of home trial)

Time (seconds)	without FES	with FES
Range	7- 77.2	7.6- 61.8

10 metre timed walk

At 3 months (end of home trial)

Time (seconds)	without FES	with FES
Range	7- 77.2	7.6- 61.8

Summary- Functional Electrical Stimulation using tilt sensor trigger

- ✓ All reported the WalkAide easy to apply and comfortable
- ✓ FES using a tilt sensor trigger is effective for a range of gait speeds and gait characteristics in people with MS and footdrop.
- ✓ FES prevents falls and improves walking
- ✓ Tilt sensor gives more choices

2. Movement control for upper limb intention tremor in MS

What is tremor in MS?

Tremor occurs during attempts at purposeful movement and is worse when approaching or at the target.

- often called ‘intention tremor’

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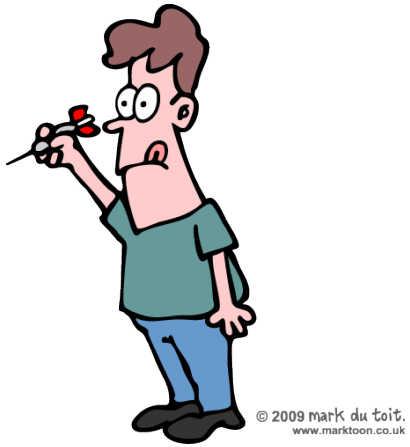
Tremor impacts on everyday activities



What is tremor in MS?

Tremor occurs during attempts at purposeful movement and is worse when approaching or at the target.

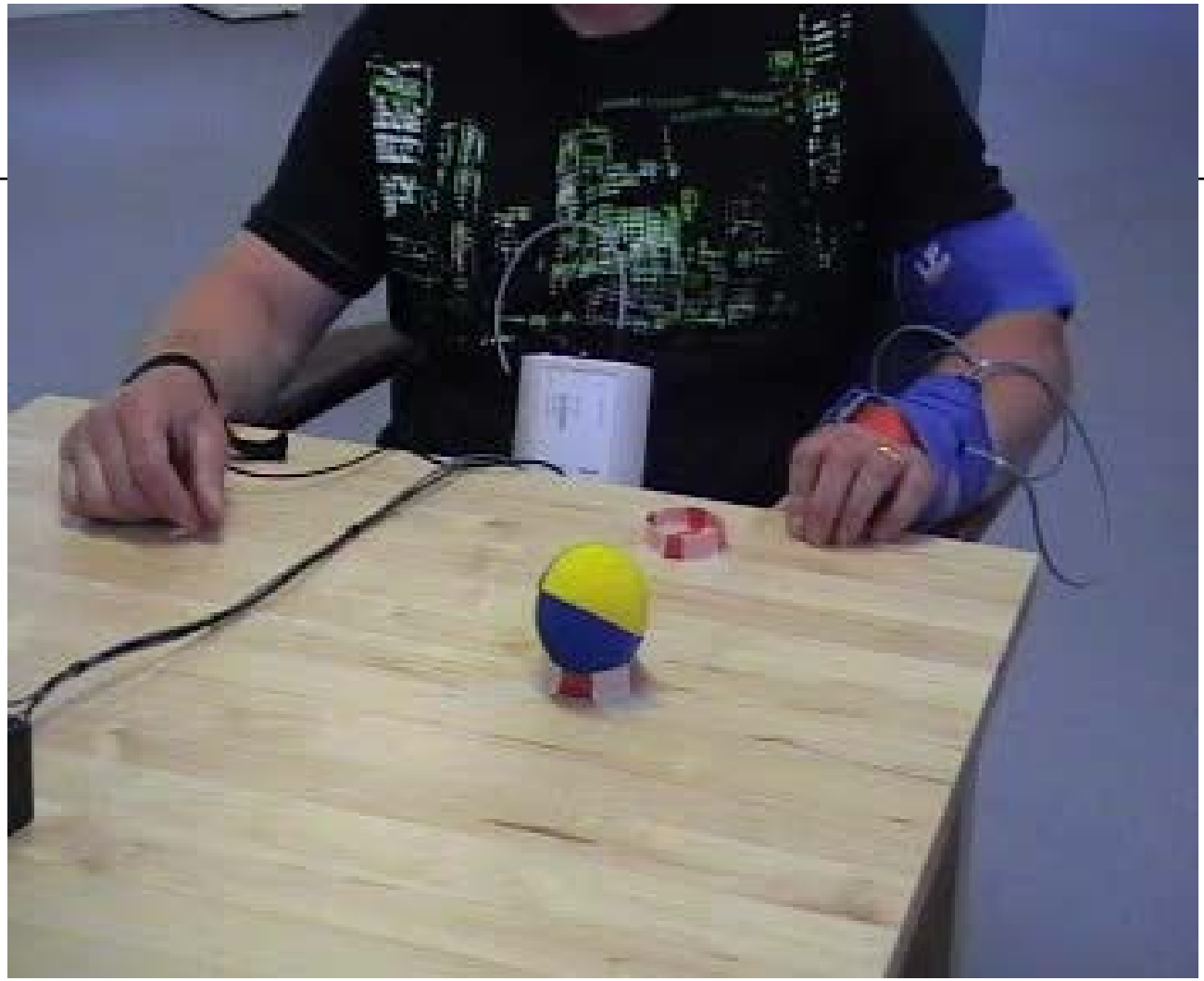
- Often called ‘intention tremor’

There is no satisfactory treatment for tremor in MS (NICE Guidelines 2003)

Features of MS related tremor

- Rhythmic frequency (usually 3-8 Hz)
- Frequently occurs with ataxic movement & muscle weakness
- Rarely seen at rest

Recording of a reach-retrieve task (functional)

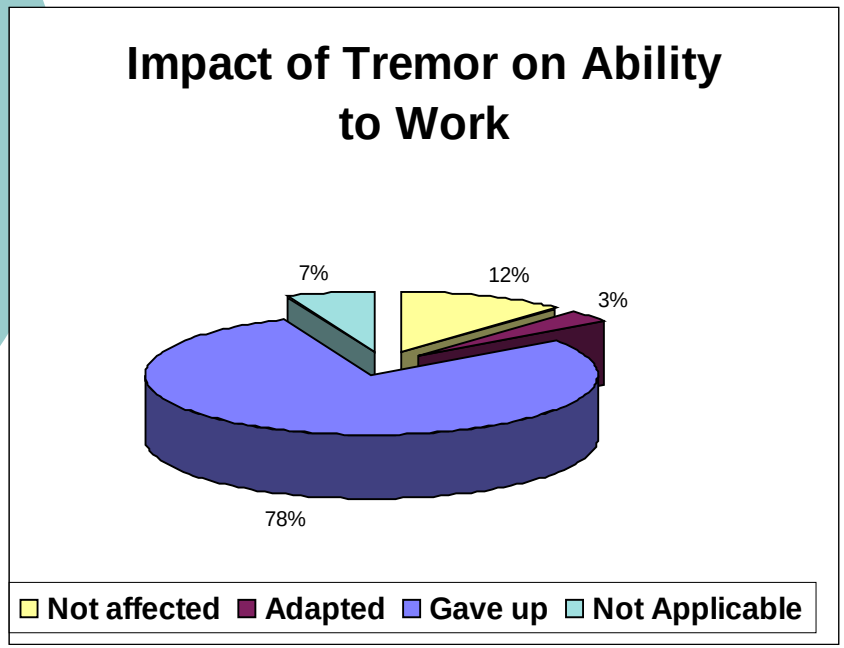


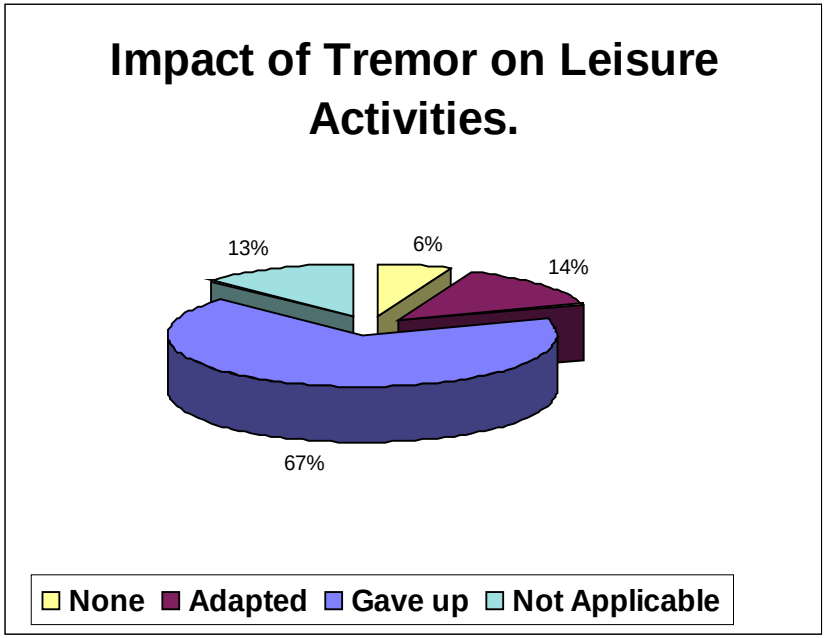
Impact of Tremor

- Occurs when intentional movements are made
- Often in both arms
- Approx. 30%* PwMS have tremor severe enough to affect activities of daily living (ADL)
- 10% of those affected have incapacitating tremor
- Leads to loss of independence

*Alusi et al 2001

Impact of Tremor on daily activities -user survey





EU Study 'TREMOR DE 3216'

Developing technologies to measure and control tremor

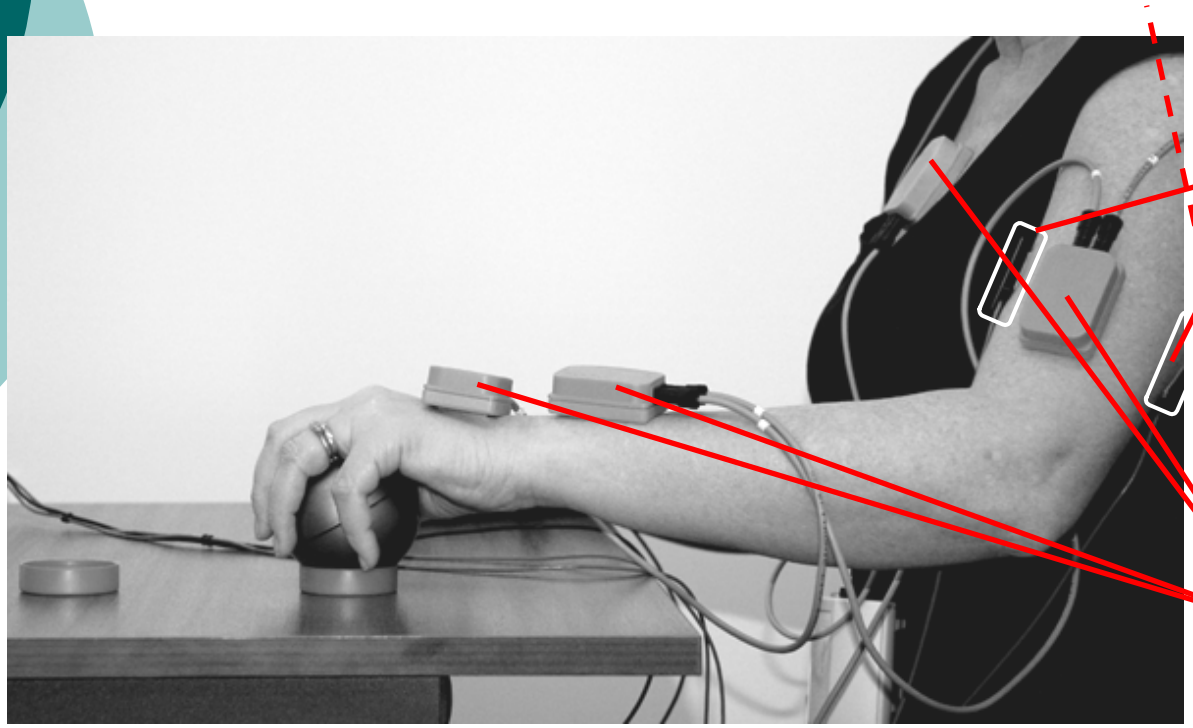
i) To develop a clinically useful measurement tool

- More objective and detailed than visual assessment
- Quick and easy to use
- Measure extent and location of tremor
- Measure effectiveness of interventions

ii) To develop a surface worn tremor control system

- develop models and design control system for intention tremor

i) To develop a clinically useful measurement tool

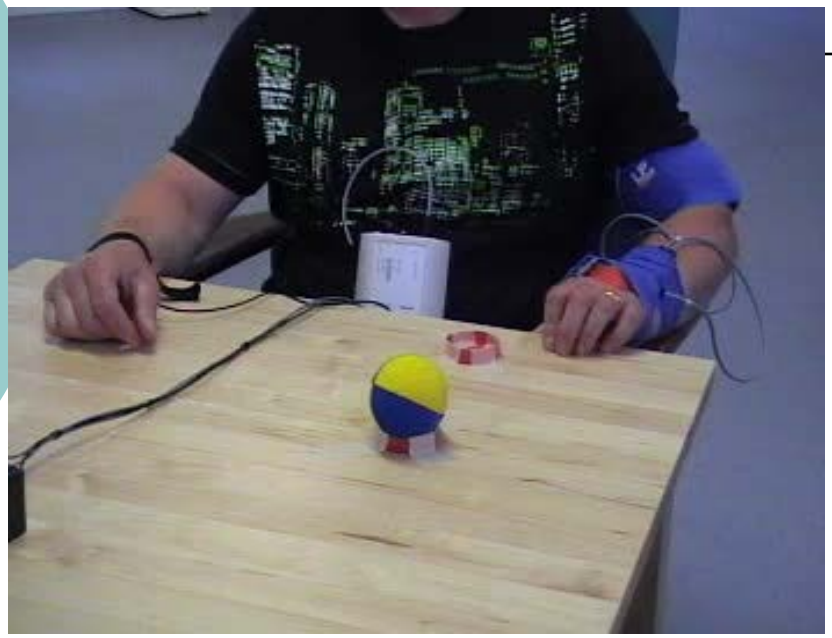


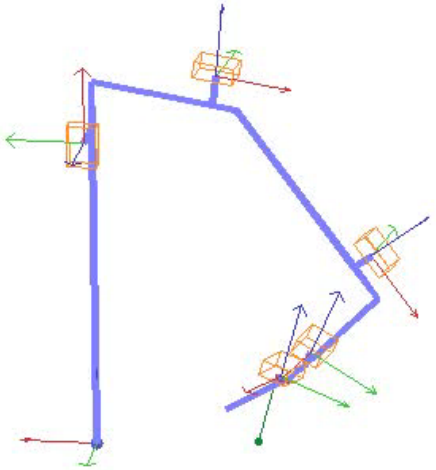
2 EMG sensors

5 orientation sensors

(sensor on top of shoulder not visible)

Sensor recording during performance of a functional reach and retrieve task

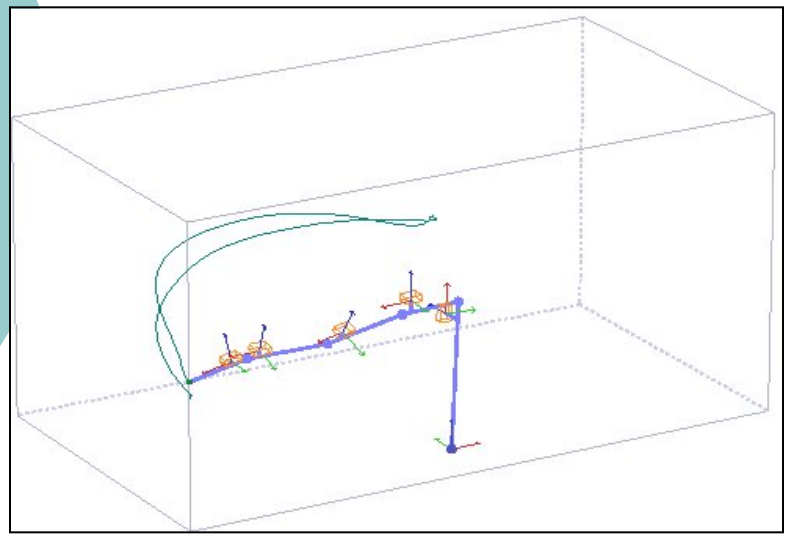




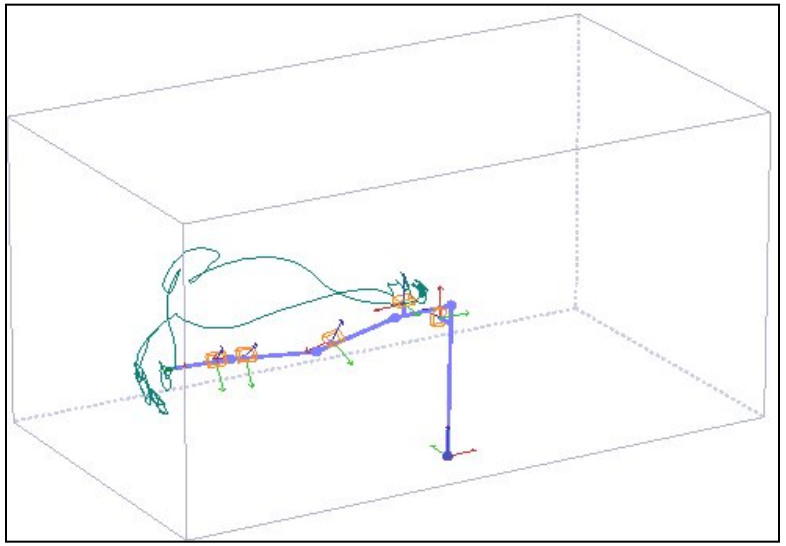
Elapsed time: 14.1
Euler angles: [X4: -8.5, Y4: 25.6, Z4: 3.0]

Finger to nose test

3D plot during a finger to nose test (viewed from behind)

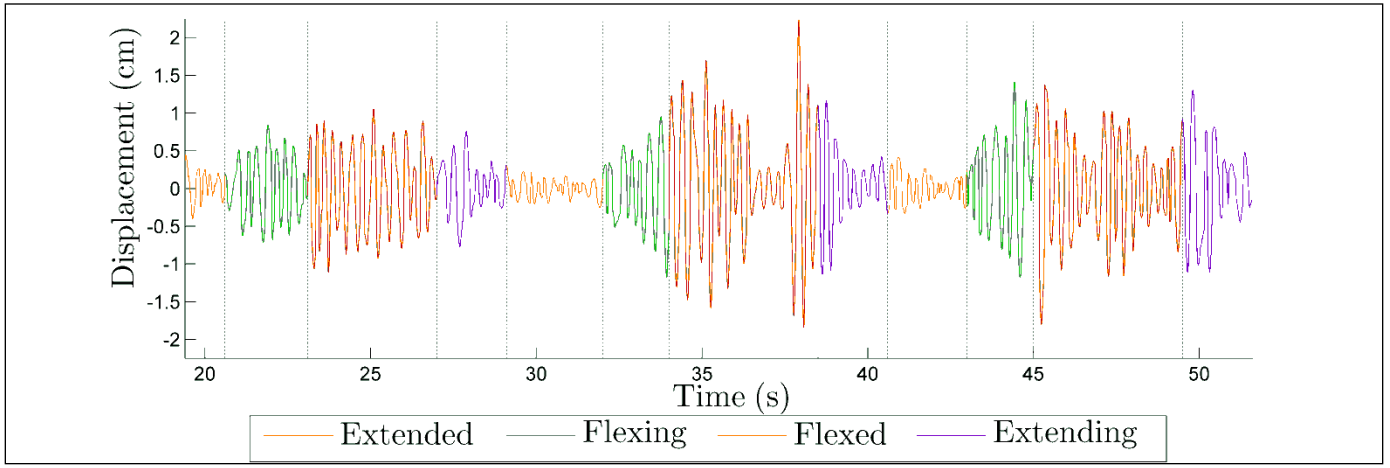


No MS - no tremor



MS & moderate intention tremor

Recording of amount of tremor (amplitude) during finger to nose test



Person with MS & moderate tremor

ii) Develop a surface worn tremor control system

- Surface worn

-needs design modification

- Damping tremor at elbow during purposeful movements

New Technology equals more choice and therapeutic opportunities for PwMS?

⇨Tilt sensor triggered functional electrical stimulation (WalkAide) for footdrop

⇨ Measurement and control system for intention tremor

Acknowledgements

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Thank you