Biomechanics of Seated Shot Put

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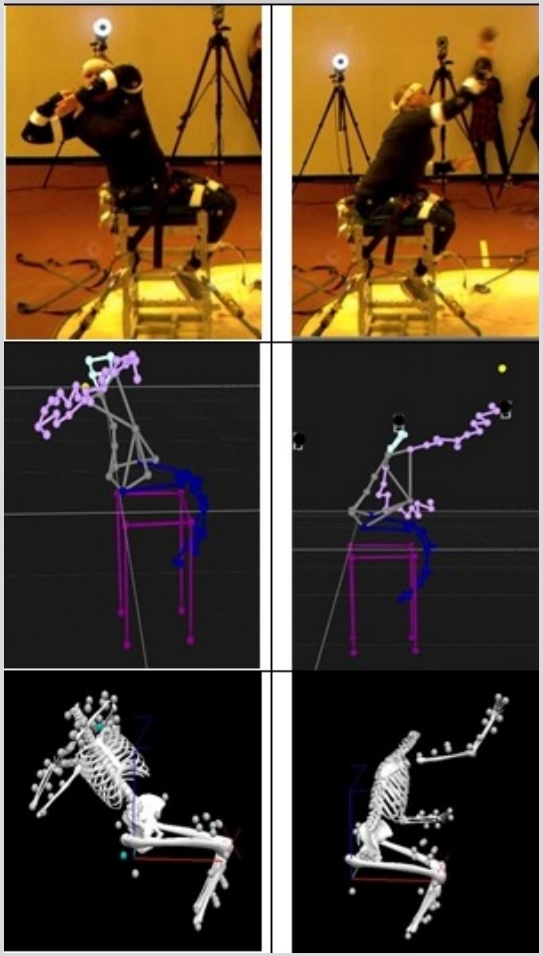

Sports Consultancy

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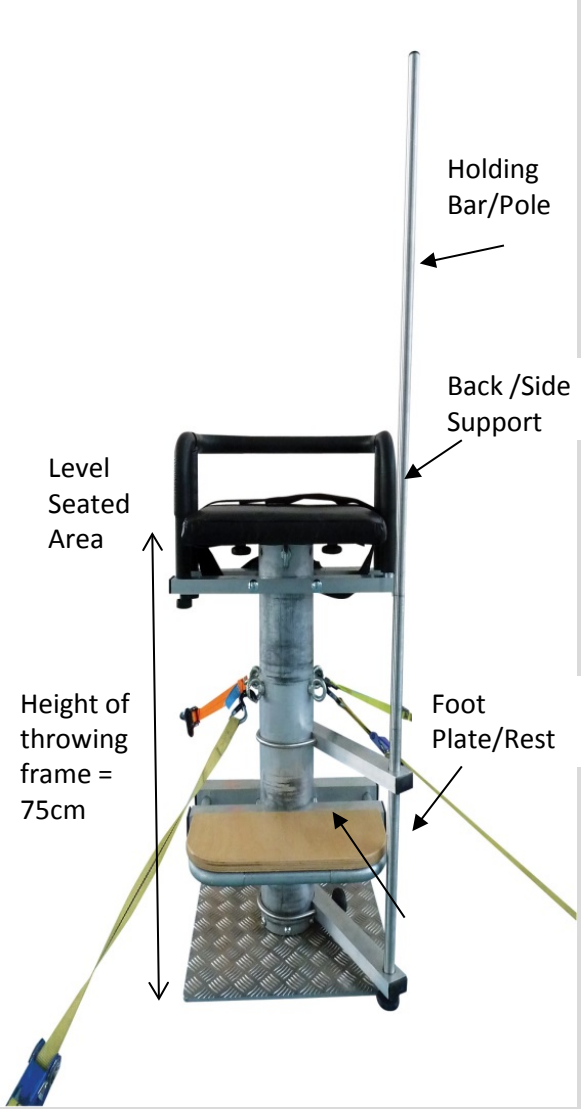
Overview

- Background to Seated Throwing
- Pilot Study 1 & 2
  - –Methods
  - –Results
- Overall Conclusions & Applications

What is Seated Throws?

- Throwing events for disabled athletes who throw from a **SEATED** position using a **THROWING FRAME**

- Athletes with
  - ➢ Spinal Cord Injury (F52 – 57)
  - ➢ Neurological conditions (F32 – 34)



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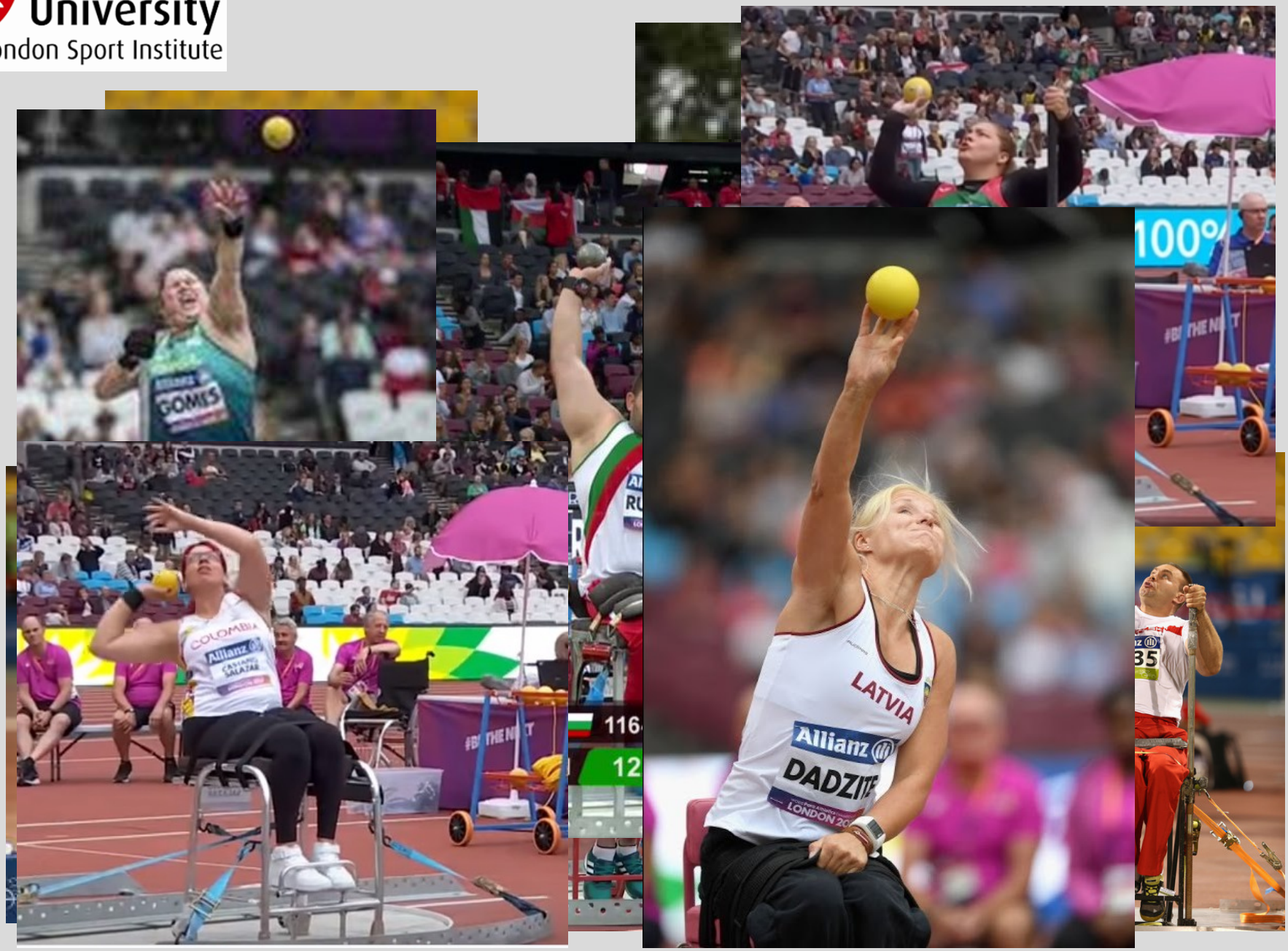

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Rationale

- Decisions made by athletes/coaches regarding throwing frame design & technique - **comfort, trial & error** (Frossard et al.2005; 2007; 2012; 2013).
- A better understanding of the **interaction** between the seated **athlete** and their **throwing frame** is needed (Keogh & Burkett 2016).

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Overall Research Project

- The interaction between throwing technique of seated shot putters and their throwing frame.

- Movement variability
- Throwing configuration
- Throwing frame design

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Introduction to Pilot Study 1 and 2

- To inform and guide methodology for Main Testing
- Novel research & methodology

- Pilot Study 1
  - Does holding pole position influence performance?
- Pilot Study 2
  - Does throwing configuration influence performance?

Methodology

- 3D Data Collection via Qualisys system
- 12 cameras (Pilot 1) – 21 cameras (Pilot 2)
- Reflective markers on joint centres

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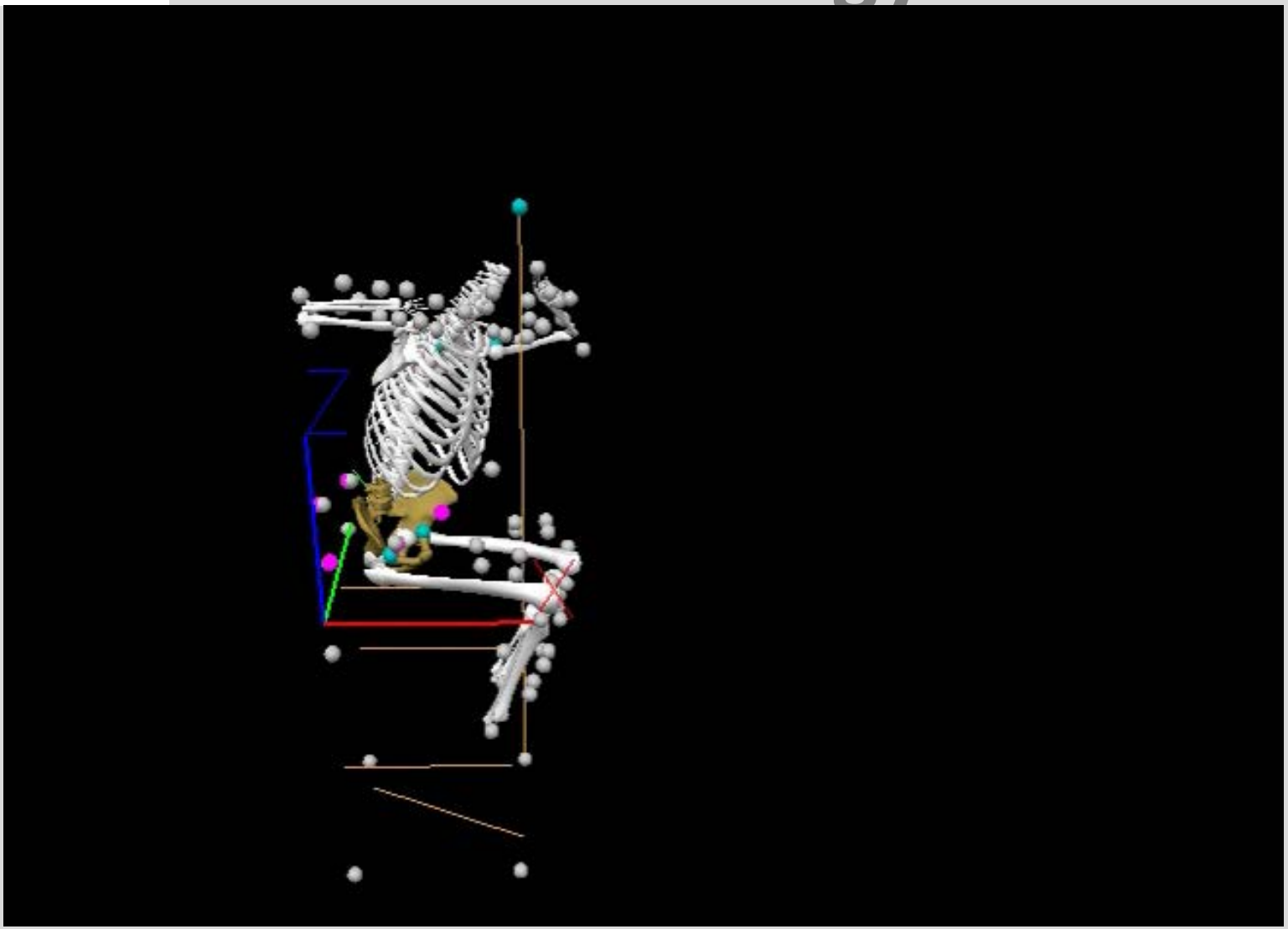
Methodology



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Pilot Study 1

- Does holding pole position influence performance?
- One elite athlete in Class F55 (paraplegia from T10) – 10+ yrs experience
- 6 trials from 2 different holding pole positions
- Distance thrown recorded after each trial

- 3D data collection via 12 camera Qualisys set-up
- Data Analysis via Visual 3D

- 2 different holding pole positions (Nearer & Further)

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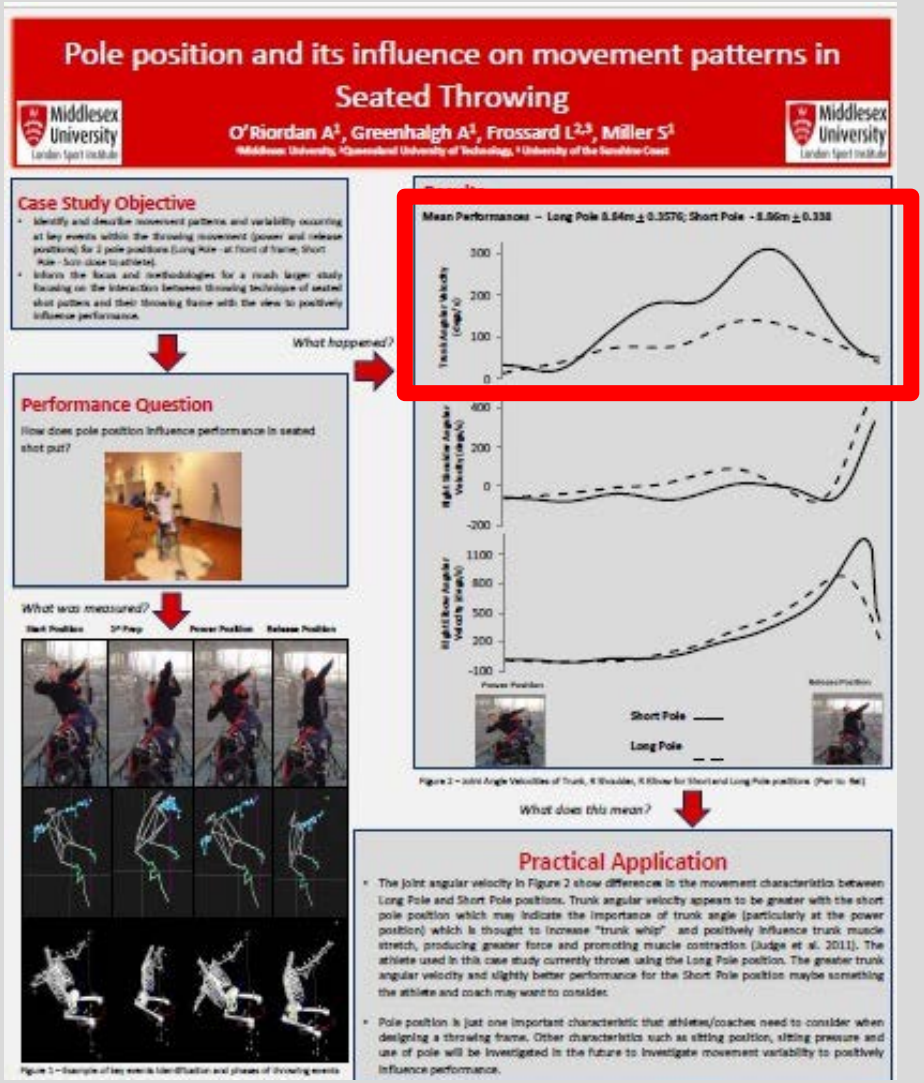
- **2 different holding pole positions (Nearer & Further)**

Results

- Trunk angular velocity greater for **NEARER** holding pole position.
- Athlete usually throws with a holding pole position **FURTHER** away from him
- Mean Performances –
  - Further Pole distance 8.84m ± 0.3576;
  - Nearer Pole distance - 8.86m ± 0.338



Poster at 2017 UK Paralympic Performance Conference

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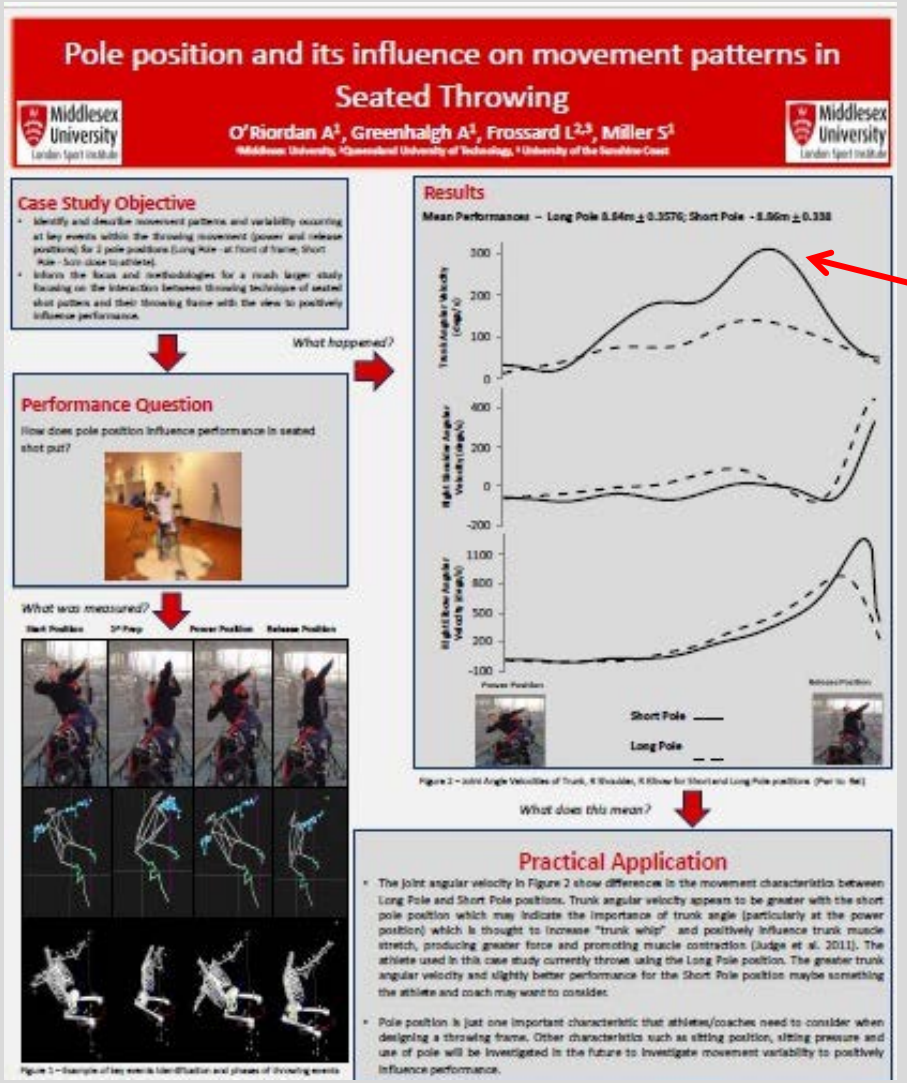

Poster at 2017 UK Paralympic Performance Conference

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Pilot Study 2

- Does seating configuration influence performance?
- One elite athlete in Class F34 (a neurological class) – 2 yrs experience
- 6 trials from 4 different throwing configurations
- Distance thrown recorded

- 3D data collection via 21 camera Qualisys set-up
- Data Analysis via Visual 3D

- **4 different throwing configurations**

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Pilot Study 2

Throwing Configuration 1	Throwing Configuration 2
Front on without pole 	*Diagonal without pole* 
Throwing Configuration 3	**Throwing Configuration 4**
Front on with pole 	*Diagonal with pole* 

4 Throwing Configurations

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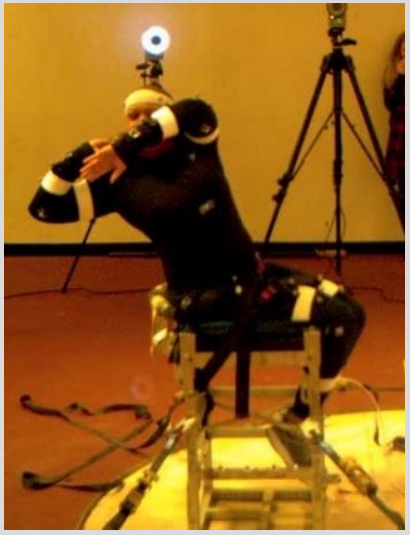
Pilot Study 2

- Does throwing configuration influence performance?

- Angular velocity – Trunk, R Shoulder, R Elbow, R Wrist
- Velocity of shot put
- Power to Release Position

Power Position



Release Position

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Results

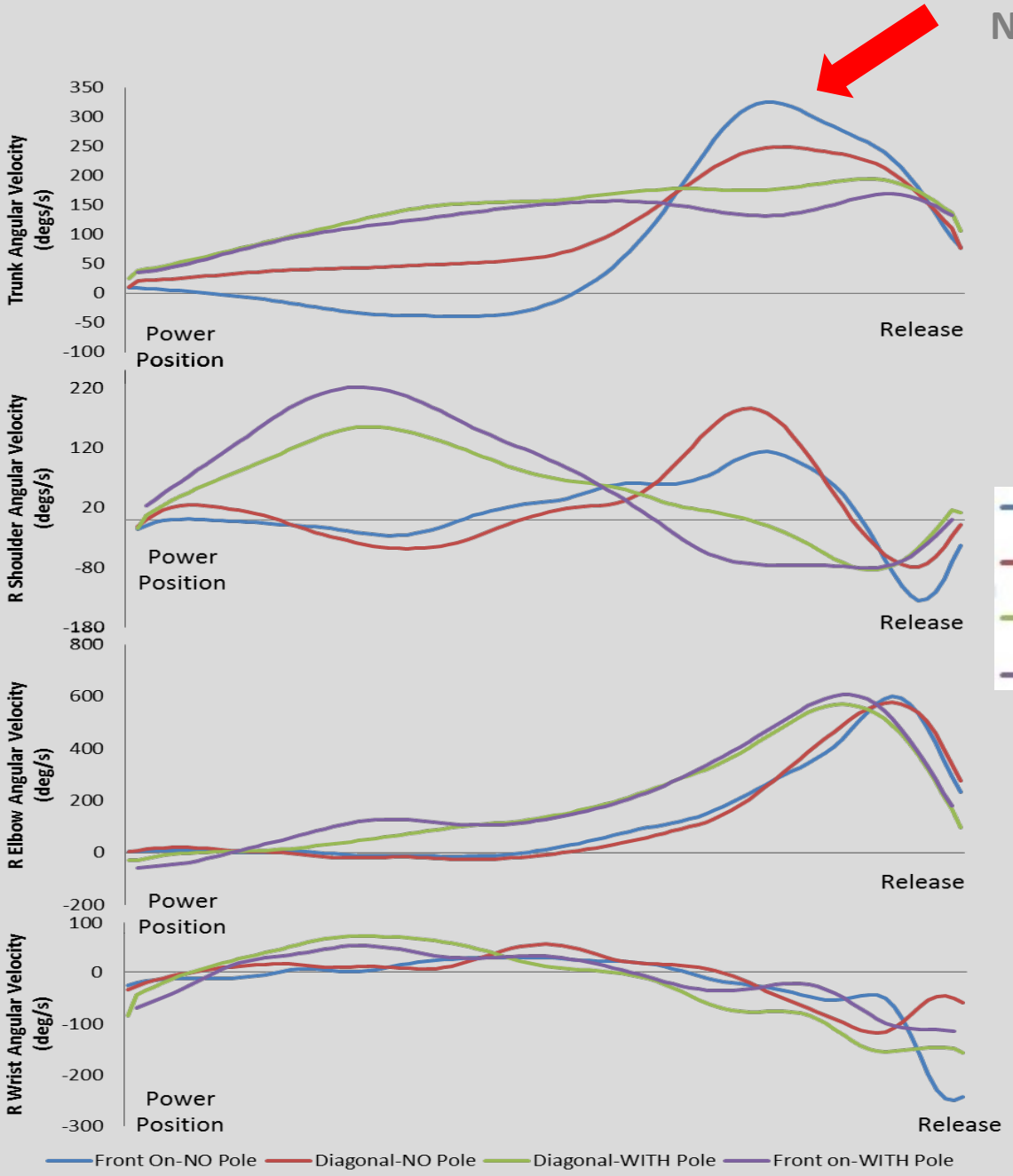
Front On
No Pole

Trunk Angular Velocity

R Shoulder Angular Velocity

R Elbow Angular Velocity

R Wrist Angular Velocity



From Power to Release Positions

Time normalised

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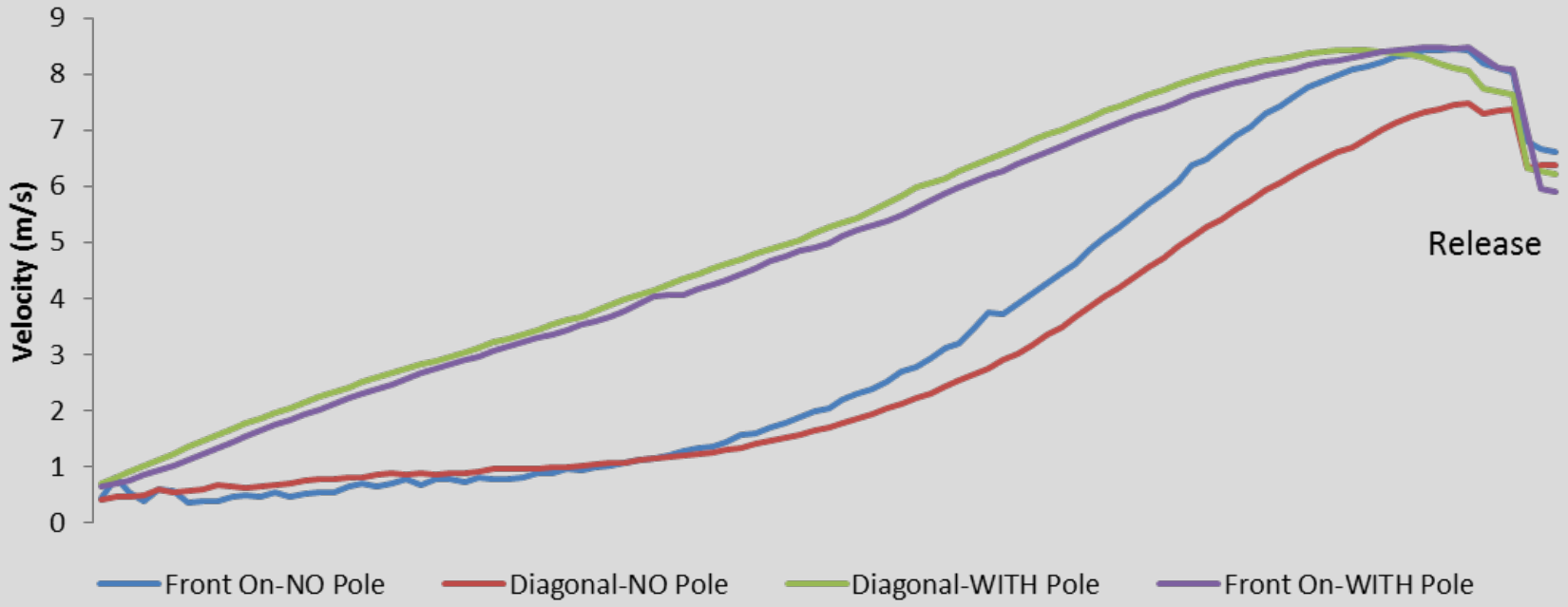
Results

Velocity of Shot Put from Power to Release Position (time normalised)



Power Position

Release Position

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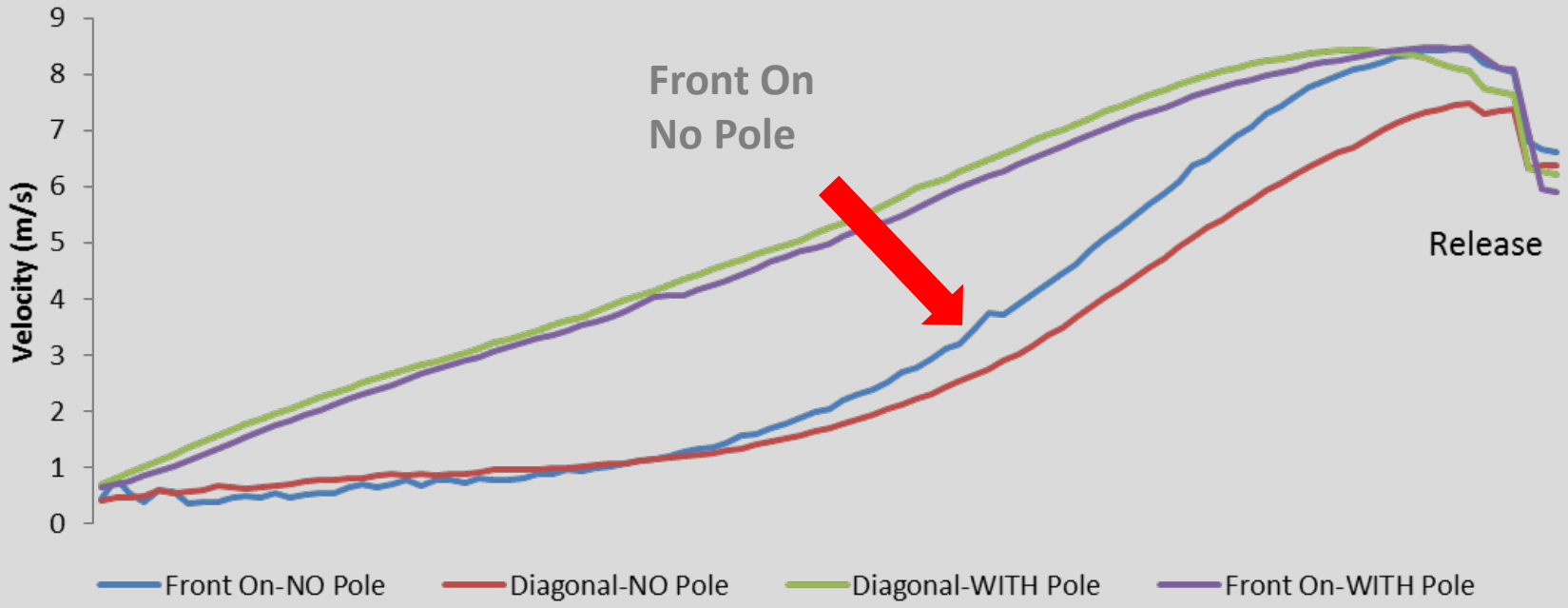
Results

Velocity of Shot Put from Power to Release Position (time normalised)



Power Position

Release Position

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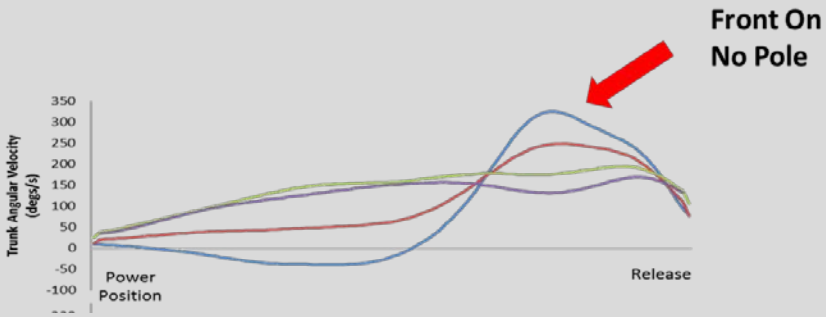
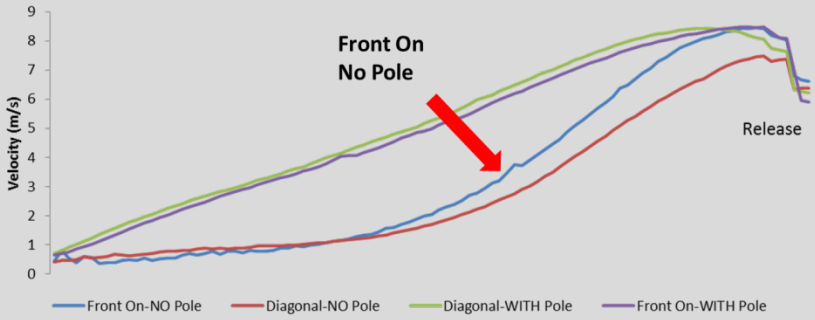
Results

	Posn 1	Posn 2	Posn 3	Posn 4
	Front On No Pole	Diagonal No Pole	Diagonal With Pole	Front On With Pole
				
Performance Mean (m)	6.48	6.26	6.23	**6.93**
SD ±	0.239784626	0.239895811	0.28241813	0.168927993

Trunk Angular Velocity



Shot Put Velocity



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Preliminary Conclusions from Pilots

- Potential interaction between seating position and holding pole
  - With holding pole – similar movement patterns
  - Without holding pole – seating position appears to affect movement pattern

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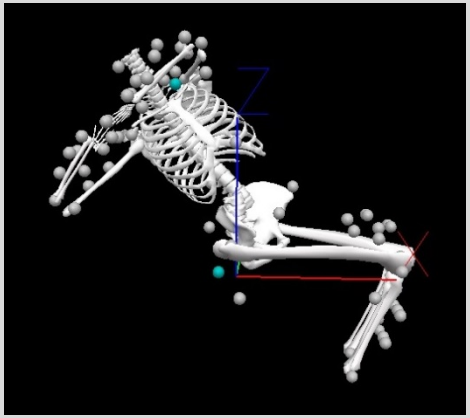
Informing Main Testing

- Methodological considerations
- Investigate potential interaction between seating position and inclusion of holding pole

Potential Practical Applications

- Provides rationale for optimising individual athlete's throwing position
  - Seating position
  - With/without holding pole
  - Holding pole position.



What Next?

Main Testing

World Para Athletics Champs

July 2017

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Invitation to Participate in World Leading

Seated Throws Research

Who?

F55, F56 & F57 Seated Throwers

What?

Biomechanical analysis of seated shot putters

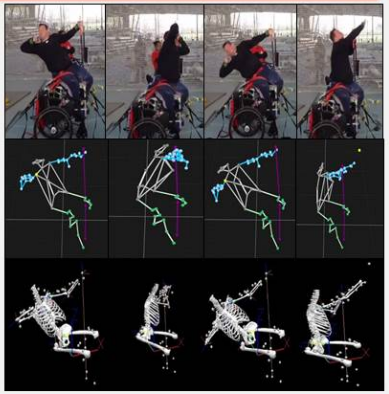
When?

Saturday 22 July 2017

Where?

Lee Valley Athletics Centre

(30 mins drive from Olympic Park)



Research Information

- This is **world leading** research, with ethics approval.
- This research is investigating the **interaction** between the **athlete** & their **throwing frame** to improve **performance** using 3D motion analysis. It will also measure sitting pressure.
- You will be asked to throw maximally from 4 different sitting positions using a generic throwing frame.
- In return you will receive a **FREE** biomechanical analysis of your own optimal throwing technique using your own throwing frame.

Expressions of Interest & Further Information

If you would like to take part or require further information, then please send an email by **01 JULY 2017** to Alison O'Riordan - **oriordan.alison@gmail.com**

Researcher Information

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Thank You

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