



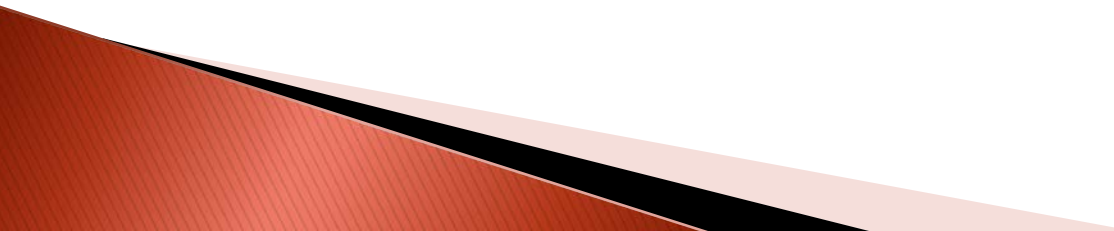
ELBOW FLEXORS-EXTENSORS MUSCLES TORQUE AND VELOCITY PERFORMANCE IN HIGH LEVEL WHEELCHAIR BASKETBALL PLAYERS

Grams L¹, Villacieros J¹, Garrido G¹, Pérez J¹, López-Illescas A², Ferro A¹.

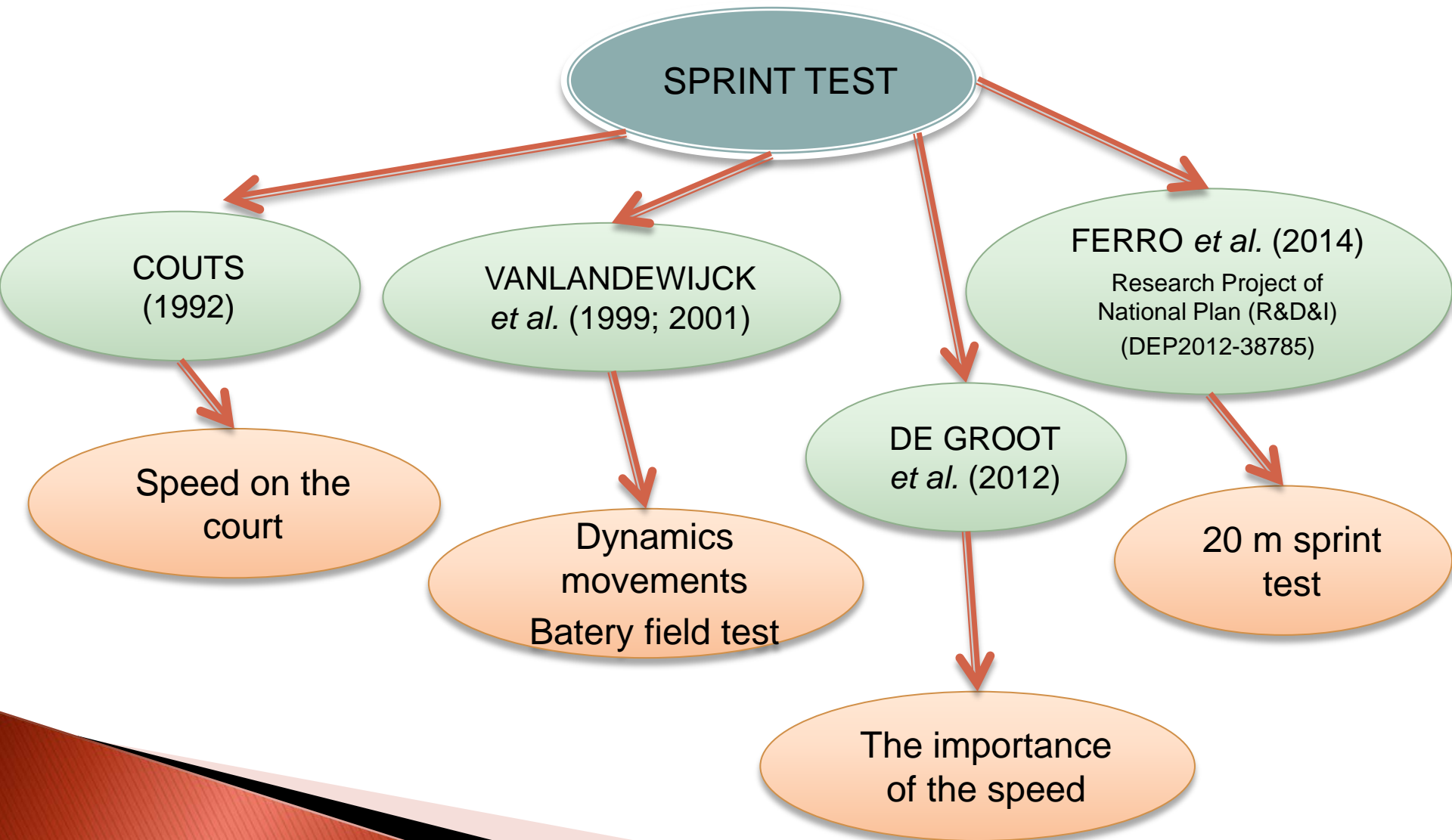
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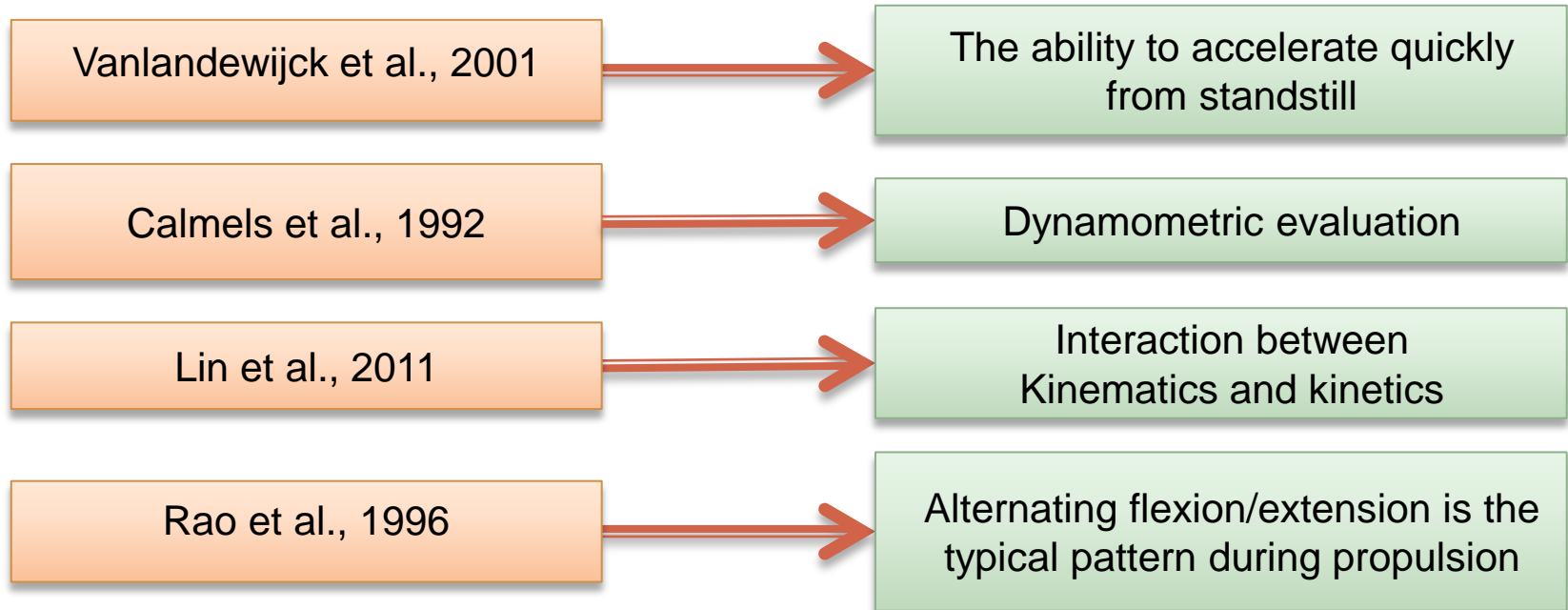
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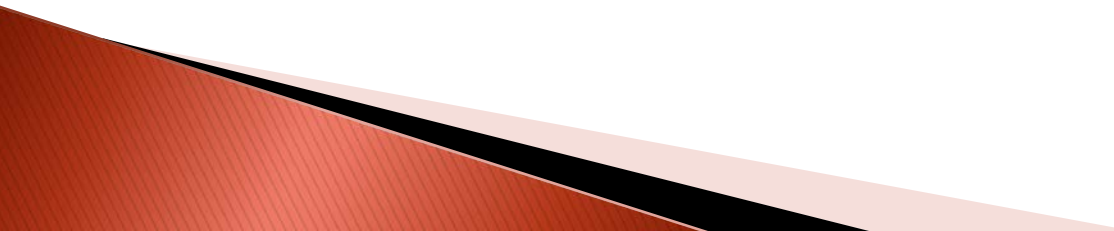
INTRODUCTION



INTRODUCTION



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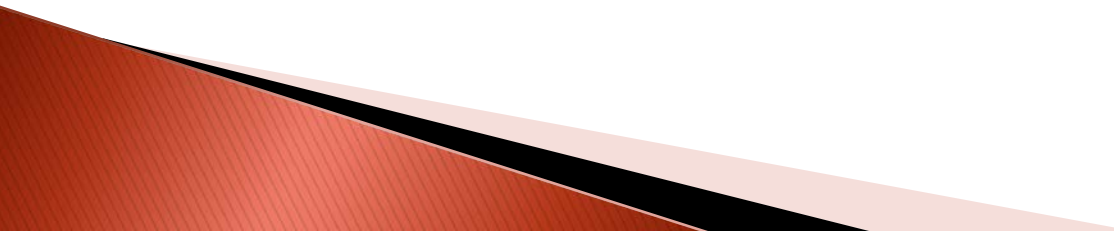
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OBJECTIVES

- ▶ To analyse the elbow torque and the relationship with the speed of the WB players in a specific test of performance.
- ▶ To identify the differences in elbow torque between dominant side (DS) and non-dominant side (NDS).



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METHODS

SPANISH NATIONAL TEAM

12 Participants

2013

MEDAL BRONZE
EUROPE CHAMPIONSHIP, 2013
FRANKFURT, GERMANY

1 month before
European
Championship

Test
Ethical
approval
(Williams, 2008)

		Weight (kg)	Height (m)	
		19.09	1.78 ± 0.08	
Class 1.5	1	39.00	68.00	1.83
Class 2.5	2	26.00 ± 5.66	72.00 ± 4.24	1.79 ± 0.06
Class 3	4	29.75 ± 6.24	74.50 ± 11.91	1.75 ± 1.84
Class 4	3	32.67 ± 4.73	88.50 ± 13.50	1.85 ± 0.03

International Wheelchair
Basketball Federation (2010)

METHODS

Kinematic analysis system in real time for the training and the sports competitions

(Ferro & Floria, 2010)

BIOLASERSPORT[®] (Ferro, 2012)

- Láser type 1 (*Jenopotik LDM301*)
 - Distance: 0.5m a 300 m
 - Frecuency: 2000 Hz
 - Precision: ± 60 mm
- Motorized Support: servo motors, bearings and encoder, video camera, card A/ D.
- BIO-BSR. (*DasyLab v.10. – Nat. Inst.*)
 - Velocity: 200 Hz – Data Filter 3Hz

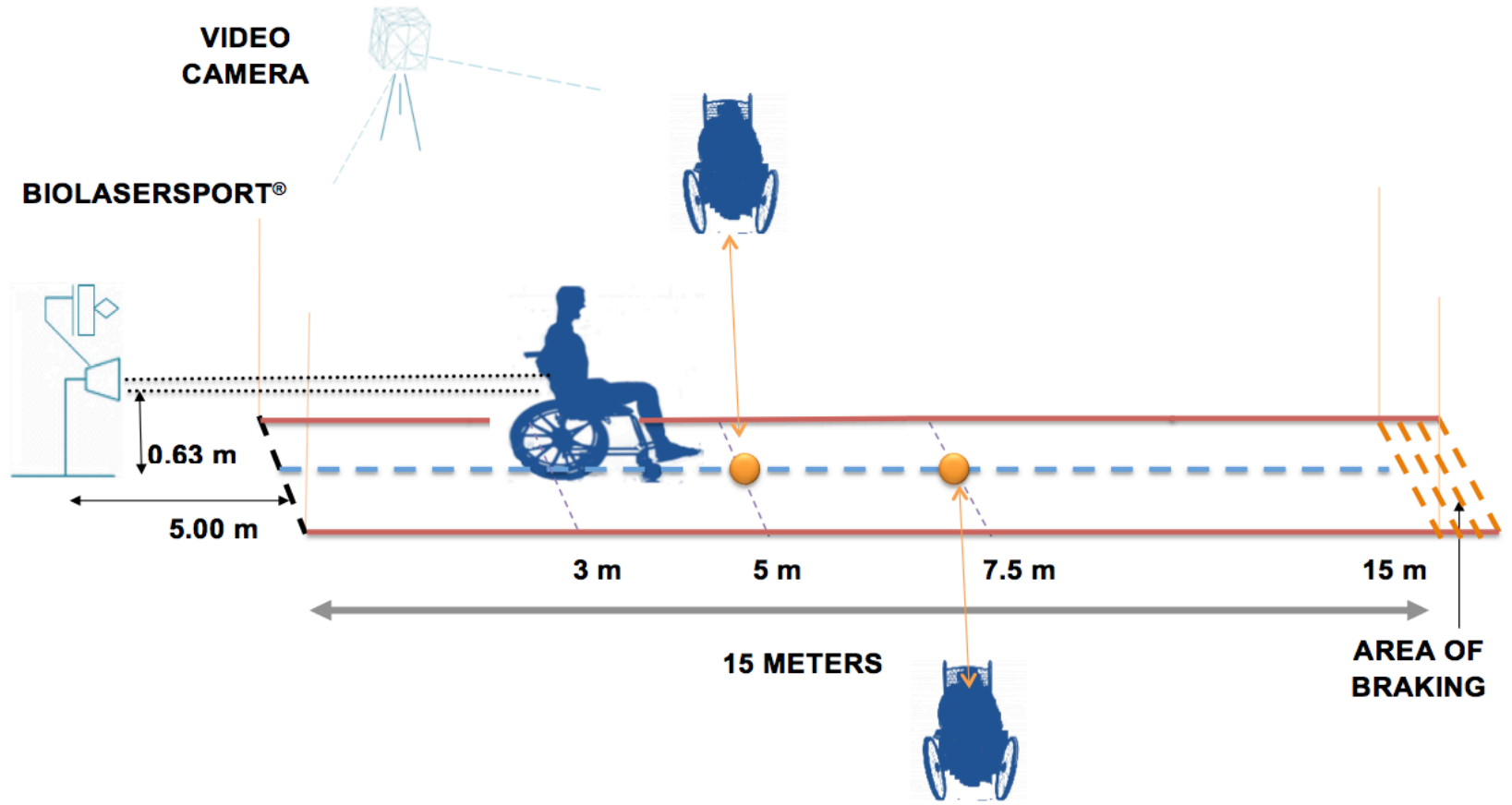
INTRACLASS RELIABILITY

	Average velocity (Vm)	Maximum velocity (Vmax)
ICC (95% IC)	0.901	0.864

Ferro, Floría, Villacieros & Aguado-Gomez, 2012

METHODS

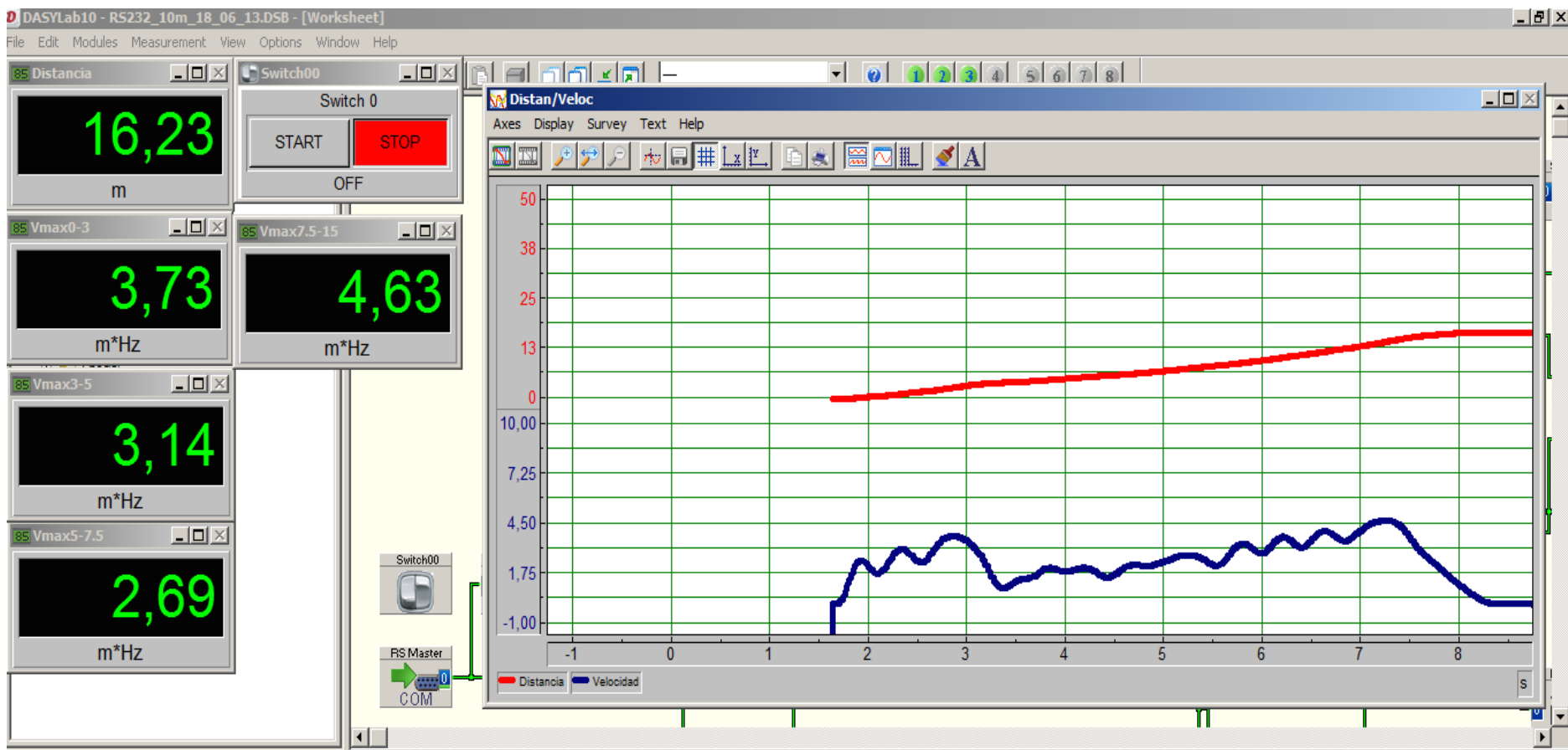
SPRINT – PASS – BRAKING





15 metres. Sprint – Pass – Braking

METHODS



APPLICATION *BIO-BSR- DasyLab*

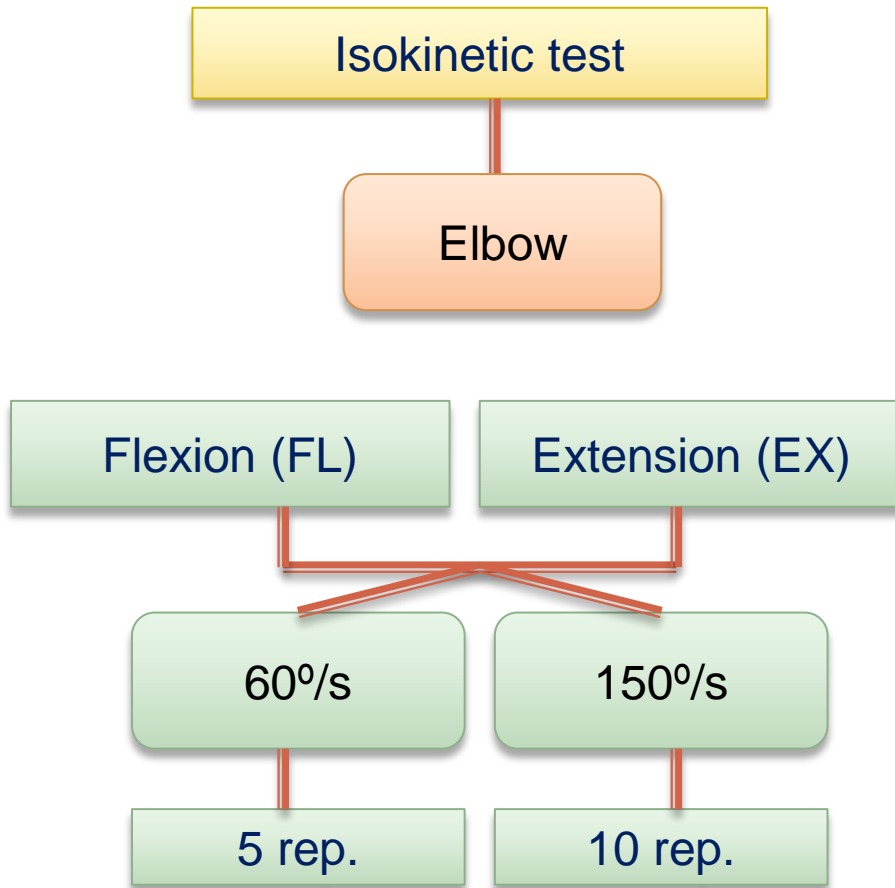
METHODS



Biodex Multi-Joint System - PRO

- Participant position
 - Abduction shoulder – 45°
 - Articular axis elbow - axis dynamometer
 - Forearm in neutral position – 0°
 - Wrist in neutral position - 0°
- Stabilization of participant
 - Adhesive straps – Chest and pelvis
- Flexion and extension elbow
 - Concentric
 - Range of 80°
- *Biodex® Advantage Software*

METHODS



METHODS

BioLaserSport[®]

VELOCITY

Average velocity
 V_m (m/s)
Maximum velocity
 V_{max} (m/s)

SECTIONS

0 – 3 m

3 – 5 m

5 – 7.5 m

7.5 – 15 m

Biodex[®]

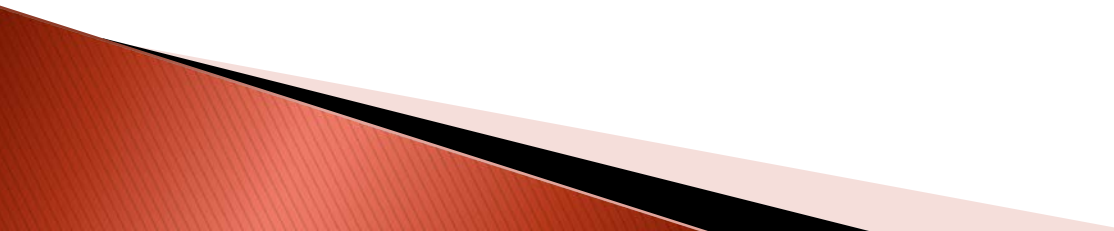
FORCE

Peak Torque
PT (Nm)

METHODS

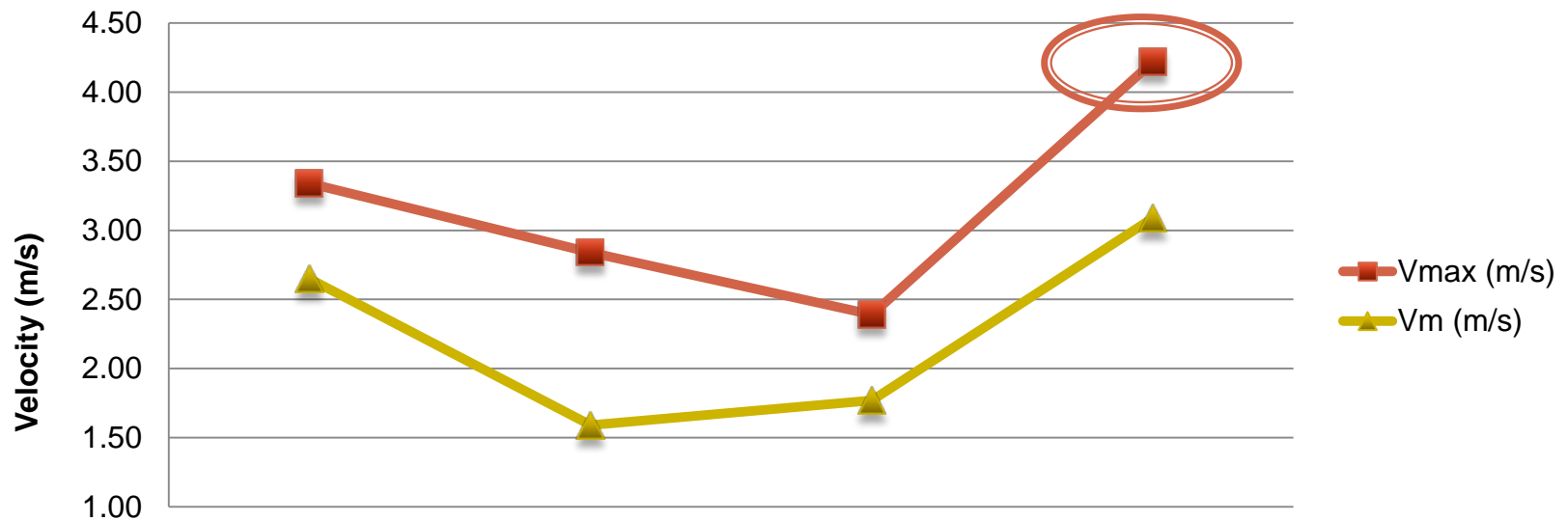
- ▶ ***Statistical Analyses:***
- ▶ Descriptive Statistics
- ▶ Normality test (Shapiro-Wilk)
- ▶ A paired student's t-test was applied ($p < 0.05$)
- ▶ Spearman correlation
- ▶ SPSS v. 20

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RESULTS

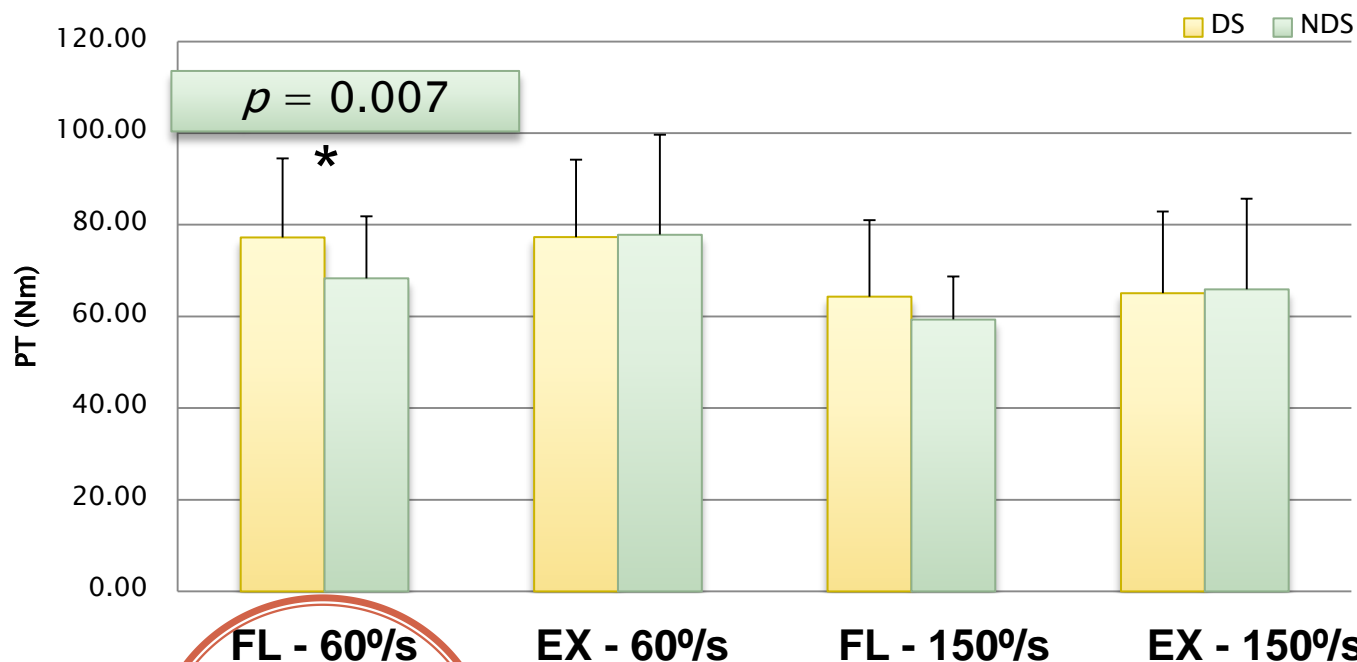
Maximum velocity (Vmax)
Average velocity (Vm)



	0 - 3 m	3 - 5 m	5 - 7.5 m	7.5 - 15 m
Vmax (m/s)	3.34 ± 0.30	2.84 ± 0.30	2.39 ± 0.32	4.22 ± 0.32
Vm (m/s)	2.65 ± 0.23	1.59 ± 0.32	1.77 ± 0.39	3.09 ± 0.39

RESULTS

Peak Torque (PT)



	FL - 60°/s	EX - 60°/s	FL - 150°/s	EX - 150°/s
DS (Nm)	77.25 ± 17.27	77.33 ± 16.86	64.33 ± 16.7	65.08 ± 17.82
NDS (Nm)	68.33 ± 13.52	77.83 ± 21.82	59.33 ± 9.39	65.92 ± 19.74

RESULTS

Correlation between Vmax-Vm y PT (60°/s)

		FL-60°/s_DS	FL-60 ^a /s_NDS	EX-60°/s_DS	EX-60°/s_NDS
Vmax	0 – 3 m	,615*	.375	.462	,585*
	3 – 5 m	.469	.476	.459	.451
	5 – 7.5 m	.503	.424	.452	.472
	7.5 – 15 m	,741**	.518	.574	,732**
Vm	0 – 3 m	,748**	.417	,651*	,796**
	3 – 5 m	-.042	.221	.137	.225
	5 – 7.5 m	.413	.238	.550	.387
	7.5 – 15 m	.566	.518	,655*	.542

- *significant differences ($p < 0.05$)
- **significant differences ($p < 0.01$)

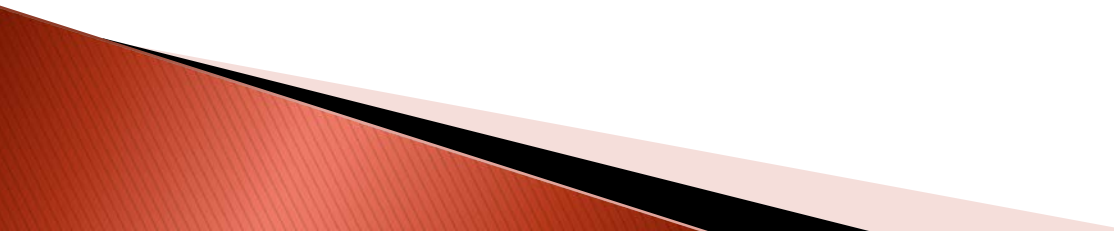
RESULTS

Correlation between Vmax-Vm y PT (150°/s)

		FL-150°/s_DS	FL-150°/s_NDS	EX-150°/s_DS	EX-150°/s_NDS
Vmax	0 – 3 m	.535	.182	.709**	.615*
	3 – 5 m	.352	.256	.575	.455
	5 – 7.5 m	.472	.273	.677*	.559
	7.5 – 15 m	.641*	.357	.737**	.741**
Vm	0 – 3 m	.577*	.144	.716**	.734**
	3 – 5 m	.099	-.011	.351	.322
	5 – 7.5 m	.430	.230	.674*	.483
	7.5 – 15 m	.528	.371	.716**	.580*

- *significant differences ($p < 0.05$)
- **significant differences ($p < 0.01$)

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CONCLUSIONS

- ▶ Flexors and extensor elbow muscles could contribute to gain speed in a 15 m velocity test in WB players.
- ▶ Asymmetry in elbow flexion PT at 60°/s in the torque applied by DS and NDS was indicative of imbalance in the flexor muscles.
- ▶ PT at 150°/s of elbow extension showed correlation with more sections of the test, being the importance velocity to train.

CONCLUSIONS

- ▶ We suggest that strength training should be increased in WB players, and also, to work on compensate DS and NDS.



**Thank you very much for your
attention**

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