WORLD AQUATICS CHAMPIONSHIPS
SINGAPORE 2025

Assessment of Elite Swimmers

A Physiotherapist Approach

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Assessment of Elite Swimmers | Goals

1 Injury Preventionn Programmes

This step begins with determining strategies to minimize the risk of injury (warm-up, cool-down, strength training, cross training activities, technique optimisation, etc.)

2 Swim Specific Rehabilitation

Creating a compelling rehabilitation protocol, with targeted exercises, shoulder strengthening, core stability, etc.

3 Load Management

Promote monitoring training load, tracking recovery.

4 Medical Management

Screening overall health and well-being. Pain Management within a multidisciplinary team.

5 Return to Sports Programmes

Conducting gradual return to water, progressive training / loading.

6 Risk Factor Mapping

7 Liaise with Head Coach

Inviting the head coach to a collaborative approach, holistic approach, technique adjustments, etc.

8 Integrative Work Environment

Multidisciplinary Team Work: Nutrition, Psychology, etc.

Holistic Approach

1. Gather ***data for the baseline***, understanding topics such as: *training history, current training load, other activities they might have, goals (short, mid and long therm), overall health condition and past clinical history;*

2. ***Athletes Own Reflection***: *strength versus weaknesses (broad aspect, broad to narrow - e.g. "anxiety", "my kick is not timed right", etc.);*

3. **Mapping Risk Factor's** - can/will guide the assessment and provide information to minimize the risk of injury *(and help define different strategies)*.

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Assessment of Elite Swimmers | Flow Chart

Postural Assessment

Potential relations between body asymmetry and unilateral load accumulation.

Step 1

Movement Screening

Series of tests designed to assess flexibility, mobility and control of different joints and muscle groups used in swimming.

Step 2

Strength Power and Endurance

Assessing the swimmer's strength and endurance, especially muscles around the shoulder and core region.

Step 3

Swimming Technique

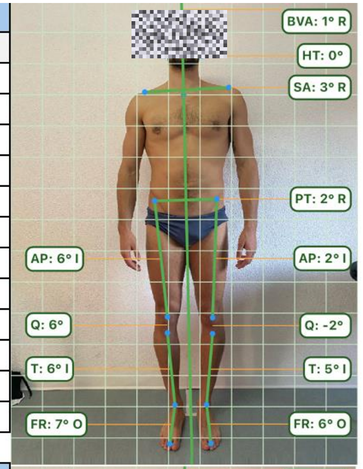
Ultimate Functional Goal

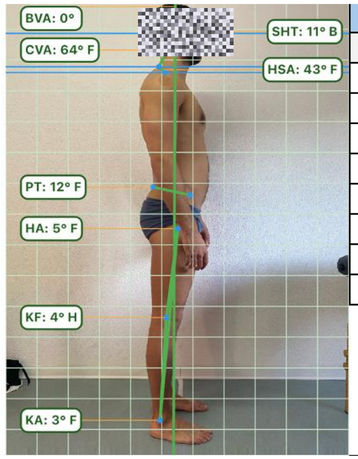
Step 4

01

“Postural assessment as a part of the screening process is relevant as there is evidence of correlations between injury and posture. Focus on the inter-relationship between the trunk and core musculature and the lower / upper quarter.”

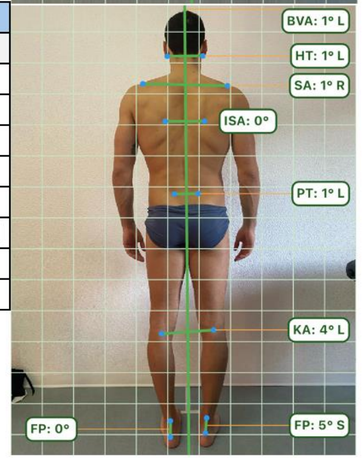
Frontal		
Ângulo	**Valor**	***Tilt***
Head Tilt (HT)	0	-
Shoulder alignment (SA)	3	Right
Pelvic Tilt (PT)	2	Right
R ASIS-Patella (AP)	6	Inwards
L ASIS-Patella (AP)	2	Inwards
R Knee Q Angle (Q)	6	-
L Knee Q Angle (Q)	-2	-
R Tibia (T)	6	Inwards
L Tibia (T)	5	Inwards
R Foot Rotation (FP)	7	Outwards
L Foot Rotation (FP)	6	Outwards
Vertical Aligment (BVA)	1	Right

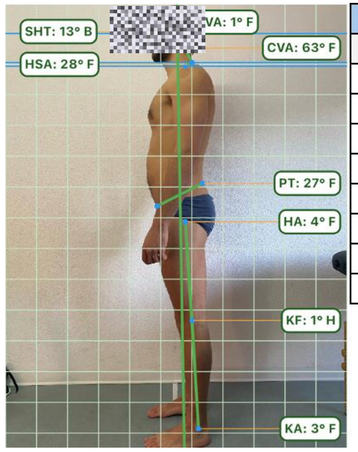




Right		
Ângulo	**Valor**	***Tilt***
Sagital Head Tilt (SHT)	11	Backward
Craniovertebral (CVA)	64	Forward
Head Shoulder (HSA)	43	Forward
Pelvic Tilt (PT)	12	Forward
Hip Alignment (HA)	5	Forward
Knee Alignment (KA)	3	Forward
Knee Flexion (KF)	4	Hyperextended
Vertical Alignment (BVA)	0	-

Back		
Ângulo	**Valor**	***Tilt***
Head Tilt (HT)	1	Left
Shoulder alignment (SA)	1	Right
Scapular Alignment (ISA)	0	-
Pelvic Tilt (PT)	1	Left
Knee Alignment (KA)	4	Left
R Foot Pronation (FP)	5	Supinated
L Foot Pronation (FP)	0	-
Vertical Aligment (BVA)	1	Left





Left		
Ângulo	**Valor**	***Tilt***
Sagital Head Tilt (SHT)	13	Backward
Craniovertebral (CVA)	63	Forward
Head Shoulder (HSA)	28	Forward
Pelvic Tilt (PT)	27	Forward
Hip Alignment (HA)	4	Forward
Knee Alignment (KA)	3	Forward
Knee Flexion (KF)	1	Hyperextended
Vertical Alignment (BVA)	1	Forward

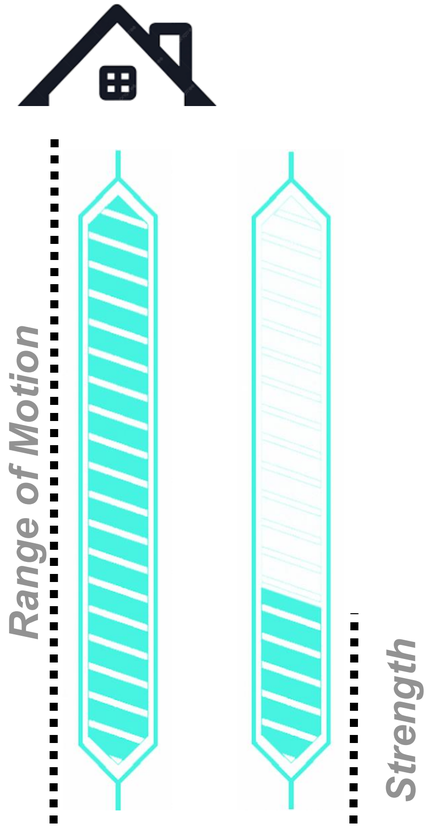
02

Range of Controlled Motion (**Active Range):** spine, shoulders, hip, knee and ankle.

Knee to Wall Test		(cm)	Dif (%)
	Right	12,4	**20,51**
	Left	15,6	

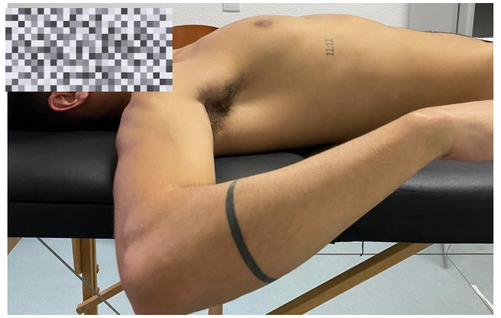
Passive Range: mainly focused on shoulders and ankles (isolated and combined total ranges of motion); If, **breastroker / IM swimmer**, add hip, knee to the equation.

	Active ROM				Passive ROM			A/P ROM
	Right (°)	Left (°)	Dif (%)		Right (°)	Left (°)	Dif (%)	Dif (%)
Plantar Flexion	65,2	70,2	**7,12**	Plantar Flexion	82,7	88,2	**6,24**	**0,14**
Dorsi Flexion	7,5	9,2	**22,67**	Dorsi Flexion	21,3	22,1	**3,76**	**5,03**



** This values are for presentation purposes.*

	Active ROM				Passive ROM			A/P ROM
	Right	Left	Dif (%)		OD	OE	Dif (%)	Dif (%)
Internal Rotation			#DIV/0!	Internal Rotation			#DIV/0!	#DIV/0!
External Rotation			#DIV/0!	External Rotation			#DIV/0!	#DIV/0!
TROM	0	0	#DIV/0!	TROM	0	0	#DIV/0!	#DIV/0!



Upper Extremity - Elevation		
Movement Pattern	(cm)	Dif (%)
Thumb Up (R)	64,3	1,71
Thumb Up (L)	63,2	
Combined Elevation / Streamline (R)	47,7	0,84
Combined Elevation / Streamline (L)	47,3	
Dominant Streamline	Right	

Combined Elevation Test

Thoracic Spine Extension, Shoulder Extension and the ability to draw the shoulder blades back

Can collect either ROM (º) or distance reached (cm)

Does it have to be this position ?

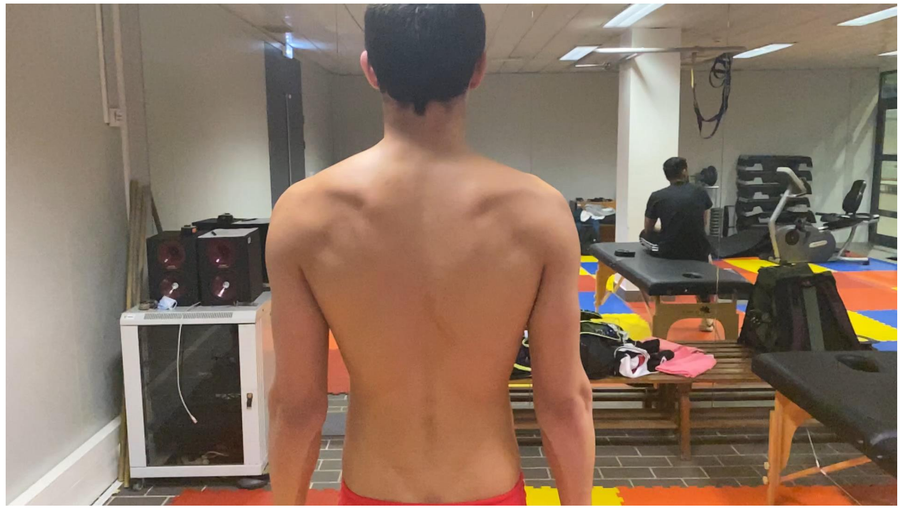
* This values are for presentation purposes.

02

Swimmer's Catch Test: Active *versus* Passive

Swimmers Catch Test			
	°	**Dif (%)**	**Obs.**
Right	147,1	**3,13**	Minimal Cut Off Value of 140°
Left	142,5		

Scapular Dyskinesis Test (SDT) | McClure Test: observe scapular movement



Special Tests: mostly dependent on they're clinical history and usually used to determine the baseline provocation and ability. Focused on more orthopaedic examination type of tests.

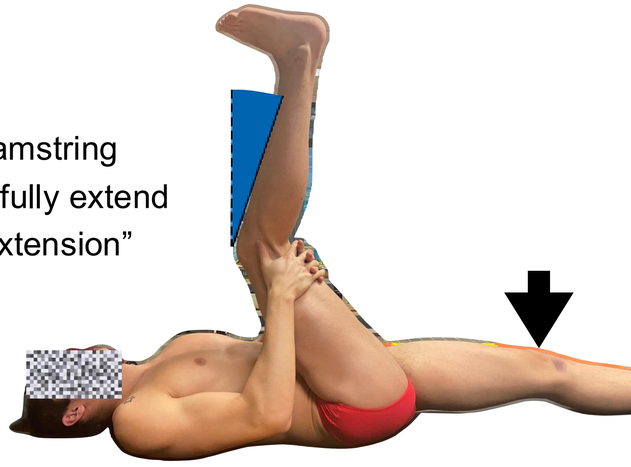
COMBINED ABD + IR

"Gives you an insight of the swimmers ability to achieve and maintain a high elbow throughout a stroke cycle"

Thoracic Rotation: Active ROM

"This range of motion is important in the pull through phases of freestyle and backstroke. An acceptable result is a value greater than 60°"

"positive test indicates hamstring tightness if the knee cannot fully extend within 20 degrees of full extension"



Posterior Chain Assessment: "Modified" 90-90 Straight Leg Raise Test

** This values are for presentation purposes.*

03

Swimmer's typical pattern ⟶ *Underdeveloped ER (control / deceleration) + (Over)Dominant IR (propulsion)*

Poor ER:IR ratio is established in literature as "injury risk"

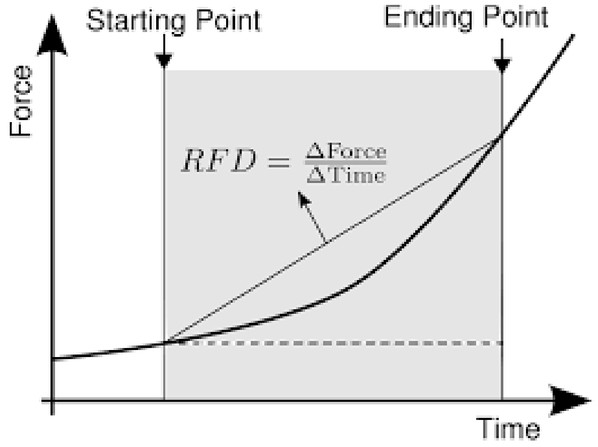
Isokinetic Strength Measurement (Hand Held Dynamometer):

<u>Are we looking correctly at this clinical aspect</u> ?

<u>How sure can we predict a shoulder injury based on the ISO Peak Strength</u> ?

Provocative Analysis:

*ISO Peak Strength **versus** Rate of Force/Torque Development?*



<u>Athletes' time-limited force-producing abilities (explosive strength)</u>

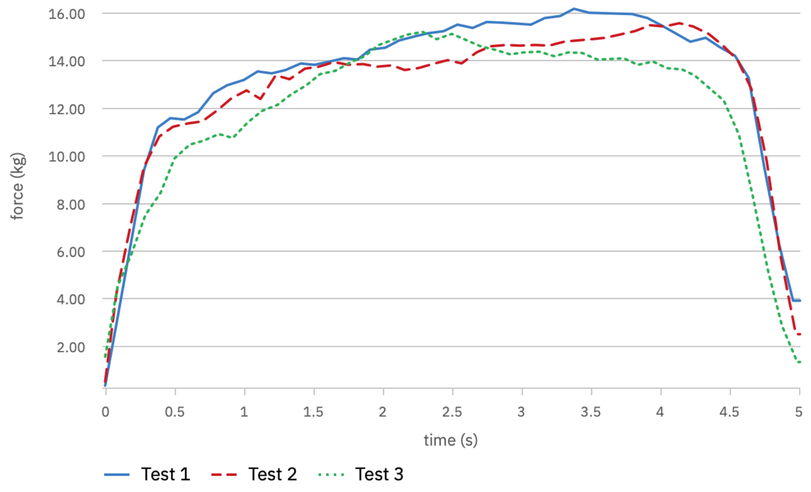
"In most strength–power sports, the key performance moments happen within very short time frames (less than 250 ms)"

03

The forgotten son of rehabilitation

Shoulder External Rotation Supine - [redacted]

Right



Average Values

Test 1	13.47 kg
Test 2	12.91 kg
Test 3	12.02 kg

Peak Force (kg)

Right	16.16 kg
Left	19.21 kg
Strength Difference	**3.05 kg**
Percentage Difference	**17.23%**

Force to Weight Ratio

Weight	77 kg
Right	20.99%
Left	24.95%
F/W Difference	3.96%

Data Collection		Internal R.	External R.	Ratio
Right Shoulder	**Average #1**	20,00	12,28	-
	Average #2	16,39	14,68	
	Average #3	16,25	13,76	
	Peak Force	**27,61**	**24,20**	**87,65%**
	Average	**17,55**	**13,57**	**77,36%**
Left Shoulder	**Average #1**	19,06	14,28	-
	Average #2	20,73	14,58	
	Average #3	20,91	13,43	
	Peak Force	**27,41**	**22,30**	**81,36%**
	Average	**20,23**	**14,10**	**69,67%**
	Strength Difference (kg)	**0,20**	**1,90**	
	Percentage Difference	**0,73%**	**8,52%**	

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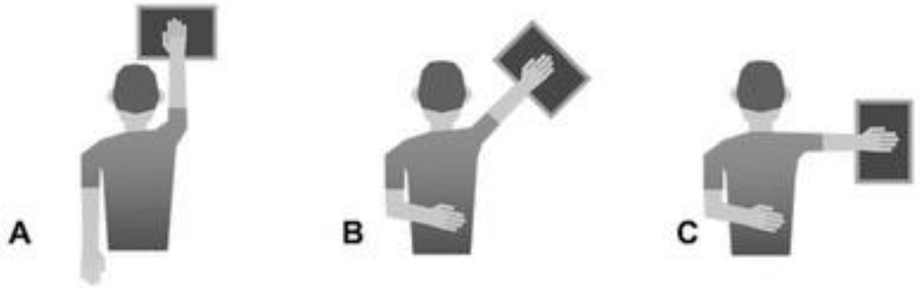
The Athletic Shoulder Test (ASH Test)

ACTIVFORCE

Ask the athlete to push down from the shoulder in three consecutive test positions maximally and “as quick as possible” for 3-5 seconds.



I-Test - Full abduction (180º)

Y-Test - Shoulder at 135º

T-Test - Shoulder at 90º

*developed by Ashworth et al. (2018)

Endurance Tests

a) ***Posterior Shoulder Endurance Test***: at 90º abduction of the shoulder hold External Rotation (ER) (add weight of 5% BW);

** position can vary depending on the targeted muscles.

b) ***Lower body***: Single Leg Hip Thrust (add weight of 20% BW);

03

Closed Kinetic Chain Upper Extremity Test (CKCUEST)

Callaway et al. argued that the distance of 91.44 cm has not been justified, recommending clinicians to use a width matching 50% of the individual's height.

"(…) low-cost performance test that provides quantitative data (scores) for an upper extremity task in closed kinetic chain with no need for high technology to be realized in sportive or clinical settings. It can help to determine deficits in closed kinetic chain upper extremity functional performance."

3 TRIALS
15s/each
45s rest

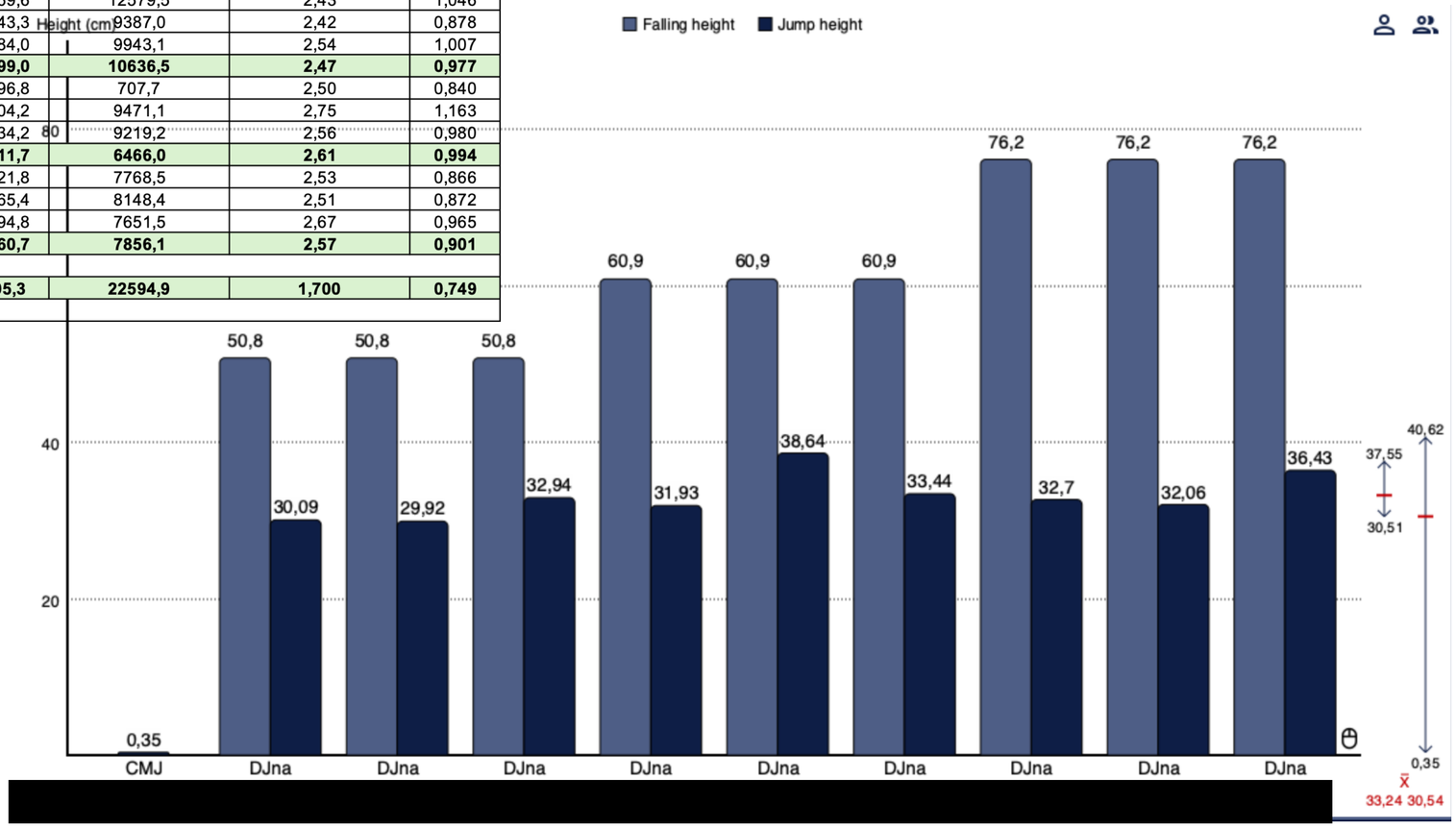
CKCUEST						
Height (m)	TRIAL	TOUCHES	ABS	Score	POWER	Cut Off
[redacted]	#1	26	30,33	16,49	105,88	< 21 touches
Weight (kg)	#2	30				
[redacted]	#3	35				

03

SQUAT JUMP (SJ), DROP JUMP (DJ) & COUNTERMOVEMENT JUMP (CMJ)									
Jump Form	**Trial**	**GRT (s)**	**FT (s)**	**Fall (cm)**	**JH (cm)**	**Power (W)**	**Stiffness (N/m)**	**Initial Speed (m/s)**	**RSI (m/s)**
Squat Jump (SJ)	**1**	0,000	0,518	0,0	32,85	932,5	0,000	2,54	0,000
	2		0,552		37,33	994,1		2,71	0,000
	3		0,571		39,93	1028,1		2,80	0,000
	MEAN		**0,547**		**36,704**	**984,9**		**2,68**	0,000
CounterMovement Jump (CMJ)	**1**		0,558		38,15	1005,0		2,74	0,000
	2		0,501		41,21	1085,6		2,96	0,000
	3		0,514		40,72	1072,7		2,93	0,000
	MEAN		**0,524**		**40,028**	**1054,4**		**2,87**	0,000
Drop Jump (DJ)	**1**	0,288	0,495	50,8	30,09	2069,6	12579,5	2,43	1,046
	2	0,341	0,494		29,92	1743,3	9387,0	2,42	0,878
	3	0,327	0,518		32,94	1884,0	9943,1	2,54	1,007
	MEAN	**0,319**	**0,502**		**30,98**	**1899,0**	**10636,5**	**2,47**	**0,977**
	1	0,380	0,510	60,9	31,93	1796,8	707,7	2,50	0,840
	2	0,332	0,561		38,64	2204,2	9471,1	2,75	1,163
	3	0,341	0,522		33,44	2034,2	9219,2	2,56	0,980
	MEAN	**0,351**	**0,531**		**34,67**	**2011,7**	**6466,0**	**2,61**	**0,994**
	1	0,378	0,516	76,2	32,70	2121,8	7768,5	2,53	0,866
	2	0,368	0,511		32,06	2165,4	8148,4	2,51	0,872
	3	0,378	0,545		36,43	2194,8	7651,5	2,67	0,965
	MEAN	**0,375**	**0,524**		**33,73**	**2160,7**	**7856,1**	**2,57**	**0,901**
Reactive Jump (RJ) (10 jumps)	**Total**	4,910	3,119	0,0					
	AVG	**0,546**	**0,347**		**15,50**	**995,3**	**22594,9**	**1,700**	**0,749**
	SD	0,992	0,084						

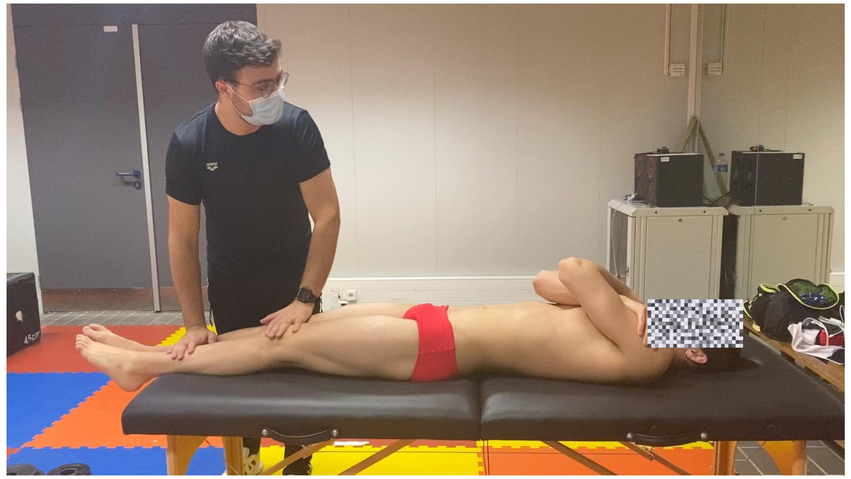
Dynamic Movement

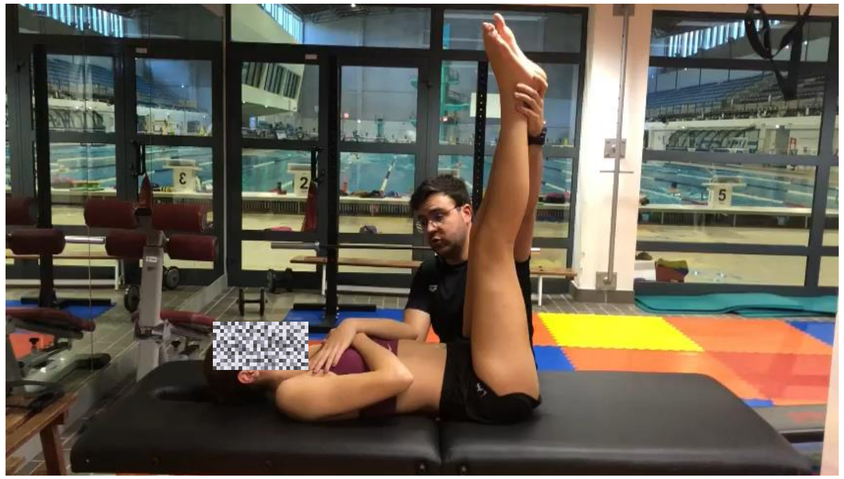
> SJ, CMJ and DJ (Start, Turns)

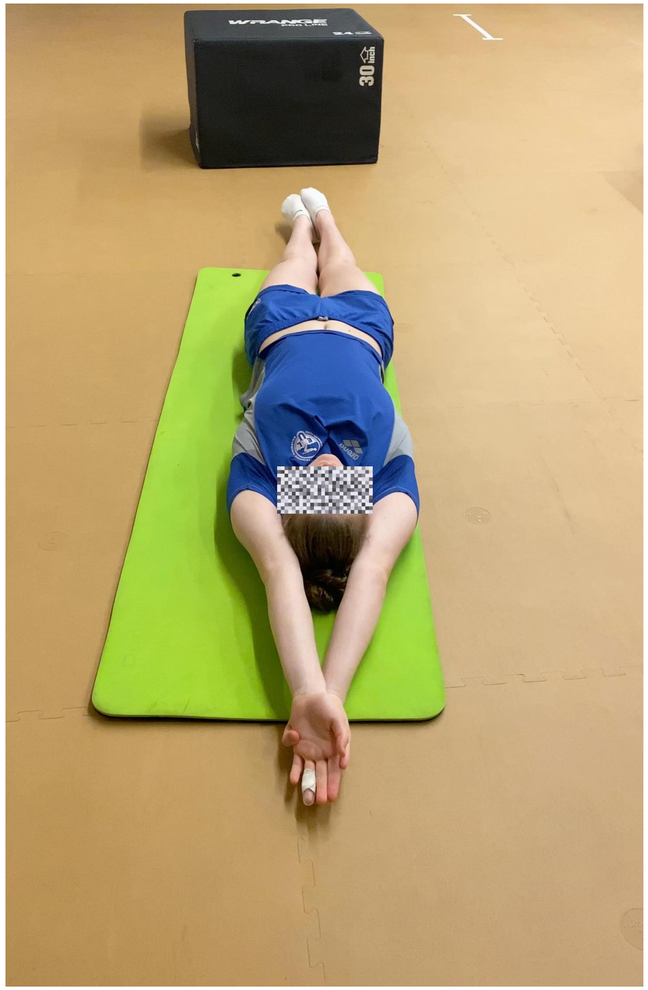


03

CORE



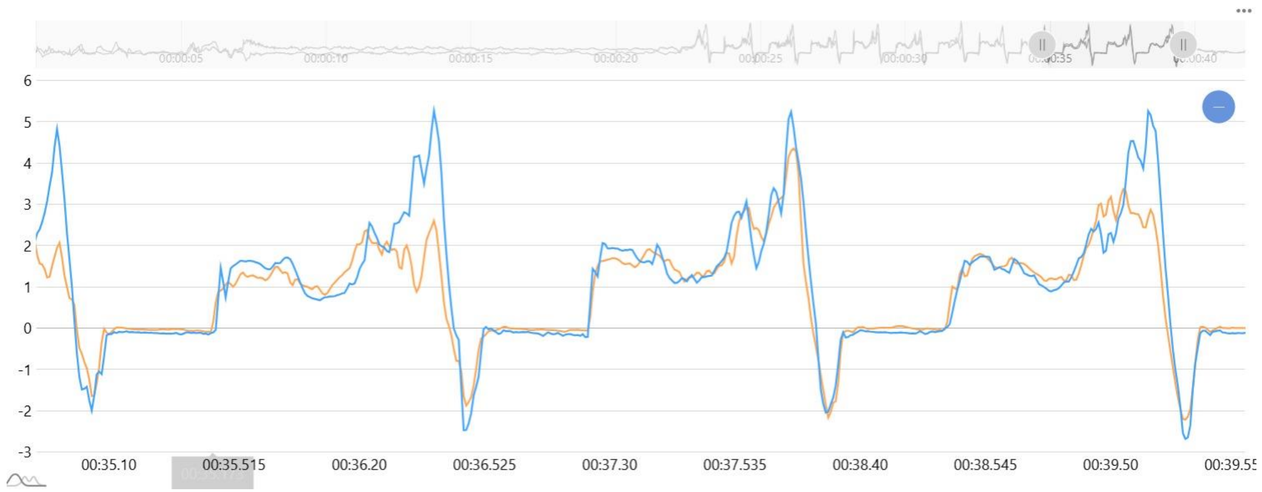


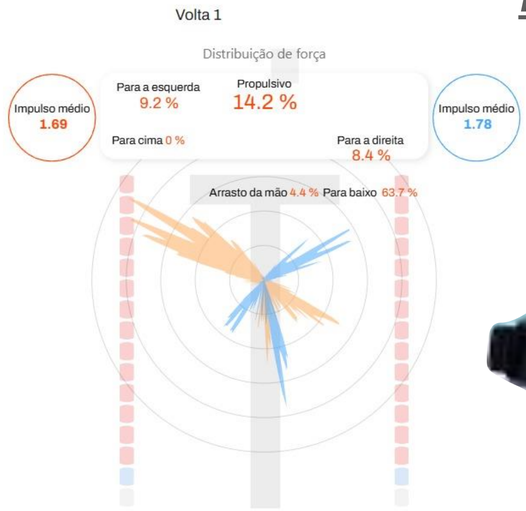


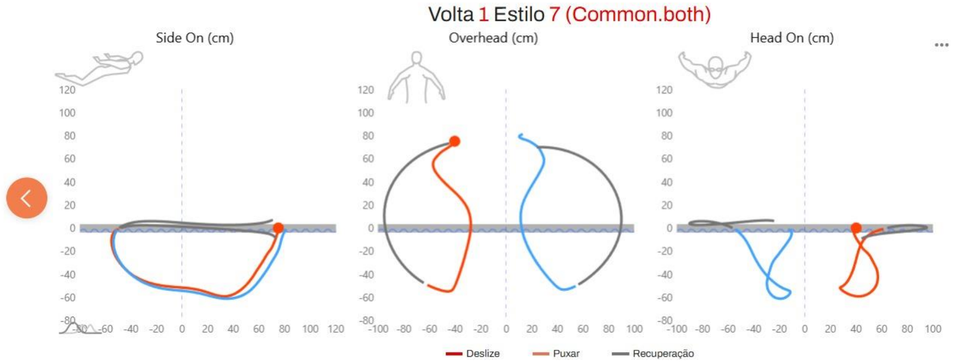
04

The importance of having a Biomechanist work in your team

Swimming is the Ultimate Functional Goal







- ***High Performance Swimming is a niche sport***. Understanding the sport and the dynamics within it **is essential.**

- **Coach -** Center Point of Information.

- **Biggest Challenges:** when is the right time to assess / re-assess? Reassessment in the same conditions? Time/assessment: 30-45 min/athlete.

- From a relatively young age swimmers are training an exceptional amount: 8-10 times per week, 3-4 gym and 1-2 complementary work session (cycling, running, etc.). Plus, some might have full time school and/or college = ***an assessment protocols can't be an extra load for the athlete.***

- Does this type of assessment makes sense for clubs / big teams ? Collecting data just to collect, is it worth it

- Don't look for the perfect recipe.

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Thank You.
Any Questions?

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