Abnormal hamstring activation at return to sport in patients after hamstring-grafted ACL-R

PhD Candidate @ University College Dublin (IRE)
Clinical Researcher @ Ortho/Trauma EOC (CH)
Sports Rehab co-founder (CH)
EU Knee Arthrofibrosis Center coordinator (CH)
MS Biomechanics

Nutarelli S[1,2], Sangiorgio A[1], Legrand T[3], Monzoni F[4], Deabate L[1], Delcogliano M[1], Delahunt E[2,5], Filardo G[1,7]

[1] Service of Orthopaedics and Traumatology, Department of Surgery, EOC, Lugano, CH
[2] School of Public Health, Physiotherapy and Sports Science, University College Dublin, Dublin, IRE
[3] School of Electrical and Electronic Engineering, University College Dublin, Dublin, IRE
[4] Sports Rehab, Lugano, CH
[5] Institute for Sport and Health, University College Dublin, Dublin, IRE
[6] Faculty of Biomedical Sciences, Università della Svizzera Italiana, Lugano, CH

ISAKOS CONGRESS 2025

A cohort observational study

Faculty disclosure information

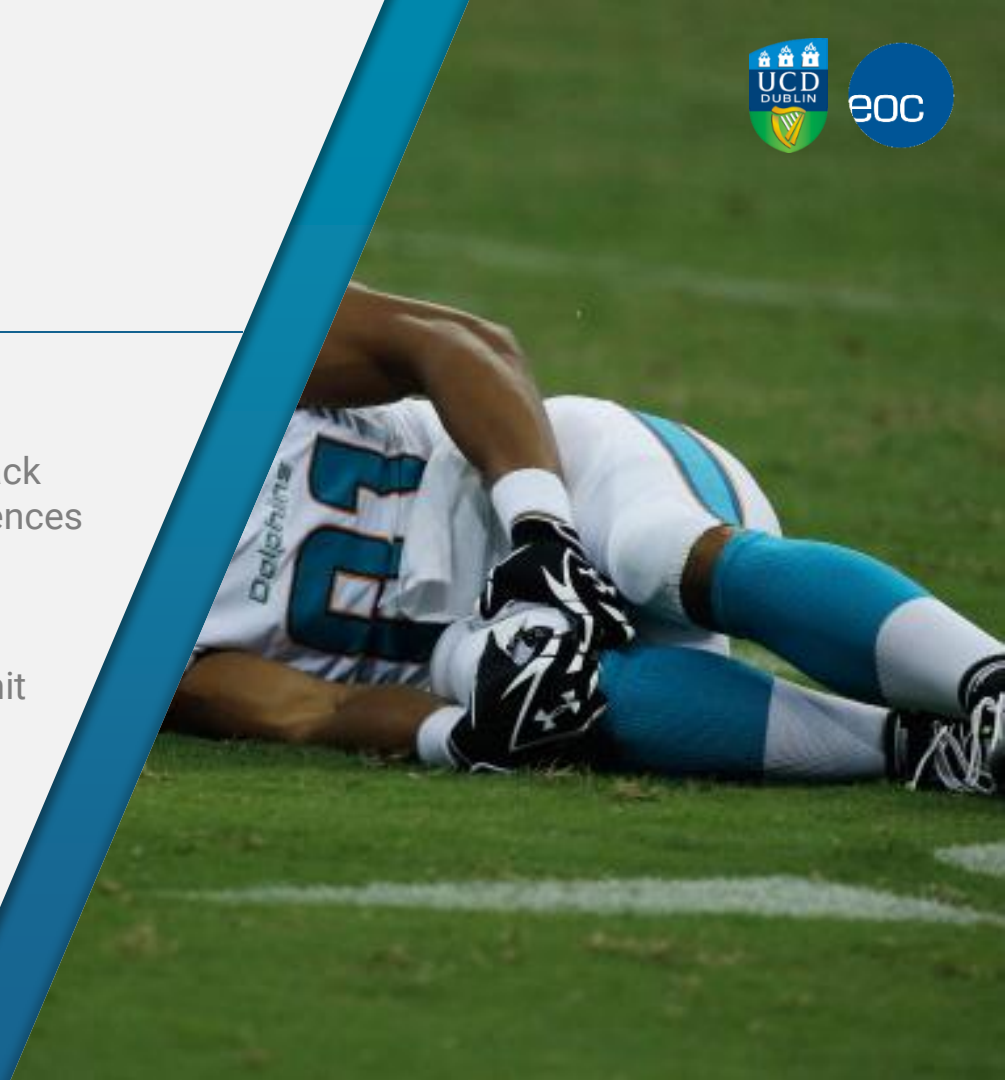
> *NO conflicts of interest to declare*

BACKGROUND

01 **ACL injuries in sports**
Frequency++ Incidence↑ Major setback for active pp. Mid-long term consequences

02 **ACL-R (HS grafted)**
Often necessary, 53% = HS autograft
Scar tissue not efficient as orig. MT unit
HS weakness (intrinsic imbalance?)

03 **HS ATT stabilizers - med/lat HS?**
Med/lat HS = Peculiar pattern (BF+ mid-late swing STG+ terminal swing)



BACKGROUND

01 **HS injuries = abnormal BF/STG pattern**
Non-physiologic recruitment >> early fatigue onset/risk of injury+, **HS graft = gr. 3 injury**

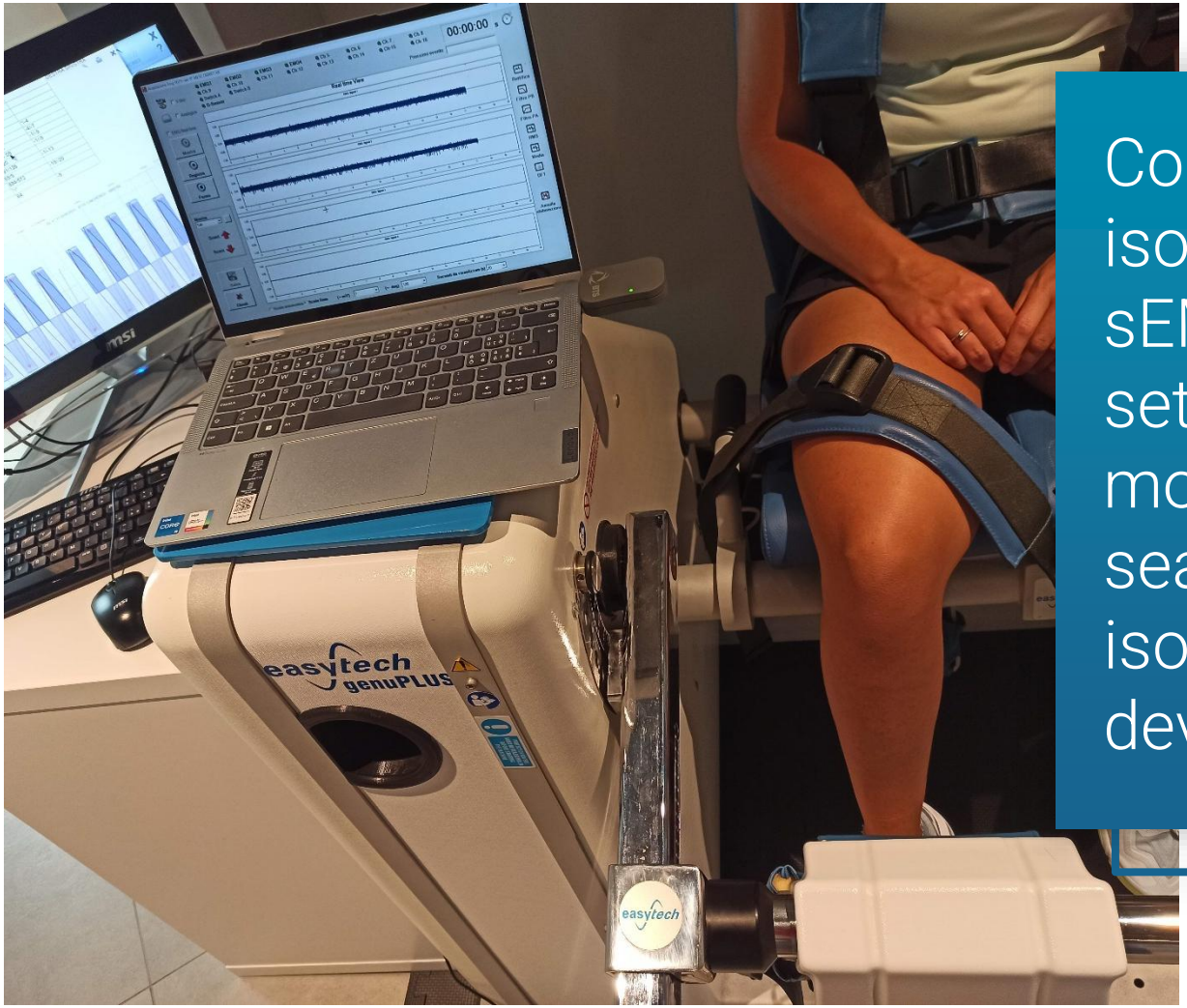
02 **RTS after HS grafted ACL-R (HS force)**
No consensus RTS ACL-R, reliable HS eval. needed = isokinetic test 'gold standard' **BUT** it measures HS tot. F (med/lat HS?)

03 **Limitation >> study aim**
HS non-phys. activation >> erroneous RTS clearance? Test ACL-R Vs controls w/ isok + med/lat HS sEMG

Material & methods

Cohort observational study

- **46 ACL-R vs. 46 healthy controls (92 pp.)**
  Controls matched for age, sex, Tegner
  Age: 28.8 ±7.6 (study gr) vs 29.4 ±6.9 (ctrl. gr), sex: 31 M/15 F (both), Tegner: 6.3 ±1 (study gr) vs 6.5 ±0.9 (ctrl gr)
- **Incl./escl. criteria**
  Study gr. INCL: age 18-45, Tegner 4-9, 1st HS-grafted ACL-R
  Associated meniscal tears incl. (untreat./repair/meniscectomy)
  Have to pass the isokinetic test (HS/Q ratio 60% & <=10% HS & Q interlimb peak torque diff. at all tested ang. vel.)
- **Testing procedure**
  From 9th mo. post-op. ACL-Rs tested (isok test + sEMG)
  5 reps @60°/s, 10 reps @180°/s, 15 reps @300°/s (30'' r)
- **Isokinetic test & med/lat HS sEMG (Δ)**
  - Intergr. diff. mean med/lat HS's sEMG amplitude (mV)
  - Intergr. diff. mean med/lat HS's sEMG timing (ms)



Combined isokinetic & sEMG test setup with modified seat of the isokinetic device

Results

MEAN sEMG AMPLITUDE MEDIAL HS

ACL-R vs. control groups resulted respectively being 0.58 ±0.06 vs. 0.58 ±0.08 at 60°/s, 0.53 ±0.05 vs. 0.54 ±0.08 at 180°/s, and 0.54 ±0.05 vs. 0.56 ±0.09 at 300°/s - **all n.s.**

MEAN sEMG AMPLITUDE LATERAL HS

REDUCED

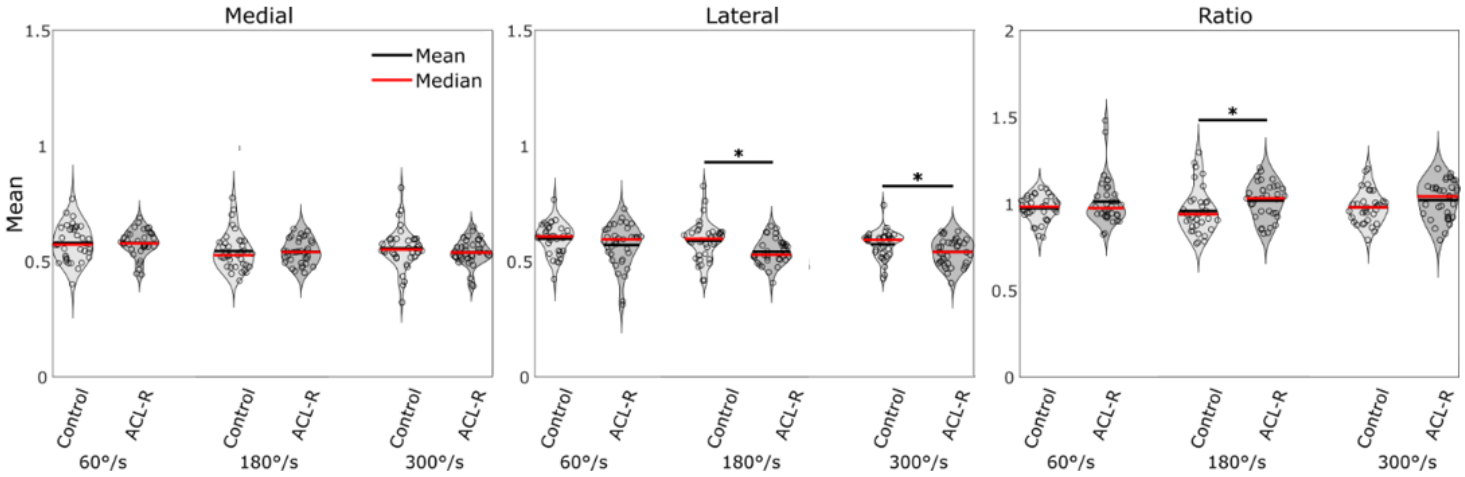
ACL-R vs. control groups was respectively 0.57 ±0.09 vs. 0.60 ±0.07 at 60°/s **(n.s.)**, 0.54 ±0.05 vs. 0.58 ±0.08 at 180°/s **(p=0.005)**, and 0.53 ±0.06 vs. 0.56 ±0.06 at 300°/s **(p=0.01)**

Normalized (peak per test) a.u.		60°/s				180°/s				300°/s			
		Control	ACL-R	*p*	*z*	Control	ACL-R	*p*	*z*	Control	ACL-R	*p*	*z*
Mean	Medial	0.58±0.08	0.58±0.06	0.8585	0.18	0.54±0.08	0.53±0.05	0.6579	0.44	0.56±0.09	0.54±0.05	0.31	1.02
	Lateral	0.60±0.07	0.57±0.09	0.2152	1.24	0.58±0.08	0.54±0.05	***0.0051**	2.80	0.56±0.06	0.53±0.06	***0.01**	2.45
	Ratio	0.97±0.07	1.01±0.14	0.6613	0.44	0.95±0.13	1.00±0.10	***0.0151**	2.43	1.00±0.09	1.04±0.10	0.09	1.68

Results

MEDIAL/LATERAL HS RATIO

ACL-R vs. control groups emerged as 1.01 ±0.14 vs. 0.97 ±0.07 at 60°/s **(n.s.)**, 1.00 ±0.10 vs. 0.95 ±0.13 at 180°/s **(p=0.01)**, and 1.04 ±0.10 vs. 1.00 ±0.09 at 300°/s **(n.s.)**



Results

MEAN sEMG TIME-TO-PEAK MEDIAL HS

ACL-R vs. control groups emerged respectively being 30 ±12 vs. 41 ±18 at 60°/s **(p=0.006)**, 40 ±8 vs. 45 ±9 at 180°/s **(p=0.002)**, and 45 ±5 vs. 48 ±4 at 300°/s **(p=0.02)**

MEAN sEMG TIME-TO-PEAK LATERAL HS

ACL-R vs. control groups resulted respectively in 37 ±15 vs. 37 ±17 at 60°/s, 42 ±8 vs. 43 ±8 at 180°/s, and 47± 8 vs. 46 ±4 at 300°/s - **all n.s.**

	60°/s				180°/s				300°/s			
Timing (%)	Control	ACL-R	*p*	*z*	Control	ACL-R	*p*	*z*	Control	ACL-R	*p*	*z*
Medial	41±18	30±12	***0.0064**	2.7	45±9	40±8	***0.0022**	3.1	48±4	45±5	***0.0195**	2.3
Lateral	37±17	37±15	0.7091	0.4	43±8	42±8	0.7132	0.4	46±4	47±8	0.8457	0.2

Results

ISOKINETIC PEAK TORQUE NORMALIZED TO BODY WEIGHT (PT/BW - N/kg)
significantly lower for the ACL-R subjects in all the tested angular velocities
(p=0.01 at 60-180°/s, p=0.02 at 300°/s)

Conclusions & considerations

- **Medial HS: mean sEMG time-to-peak = consistently faster**
  Knee biomechanics alterations on CoDs? Tibial IR++?
- **ACL-Rs w/ lower strength values than controls**
- **NM demand++ on grafted med HS in ACL-Rs at RTS**
  Previously undetected higher risk of injury?

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Sebastiano Nutarelli

www.eoc.ch

www.ucd .ie

s.nutarelli@mail.ch