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Evaluating Muscle Contraction with Tensiomyography

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What is Tensiomyography?

Diagnostic method

Contractile properties

Superficial skeletal muscle

Application areas

Sport – Performance, Injury prevention

Medicine – Rehabilitation monitoring

Research – Scientific publications

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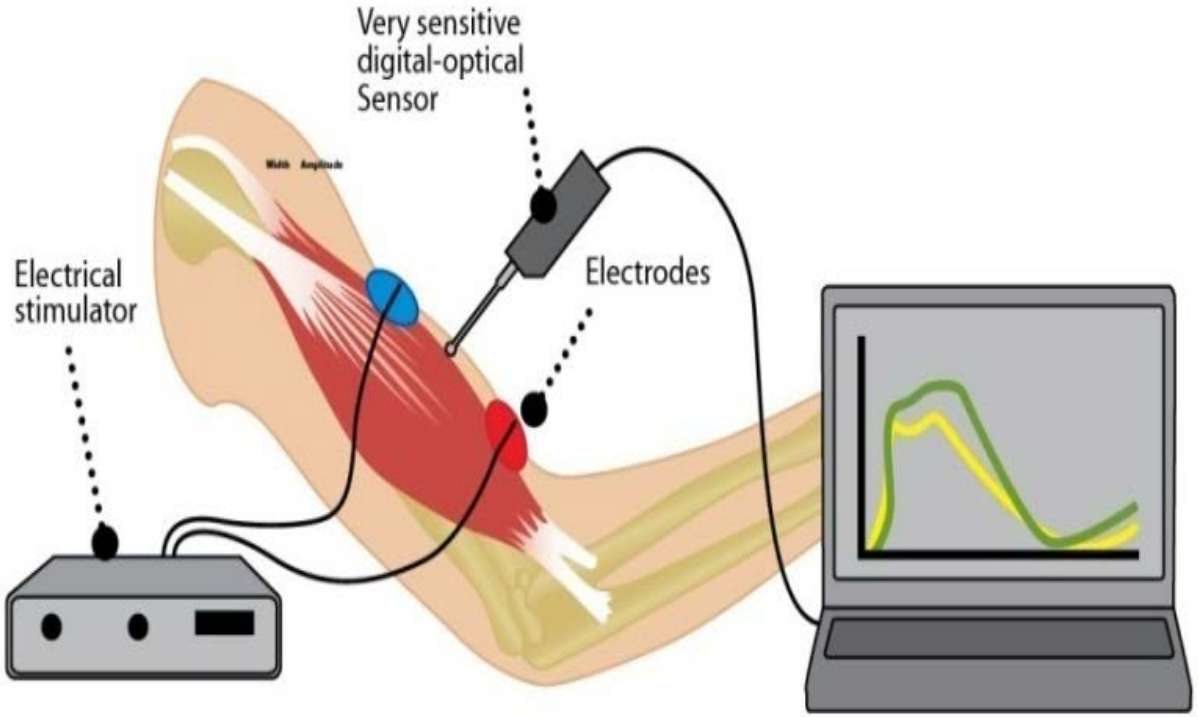
Tensiomyography



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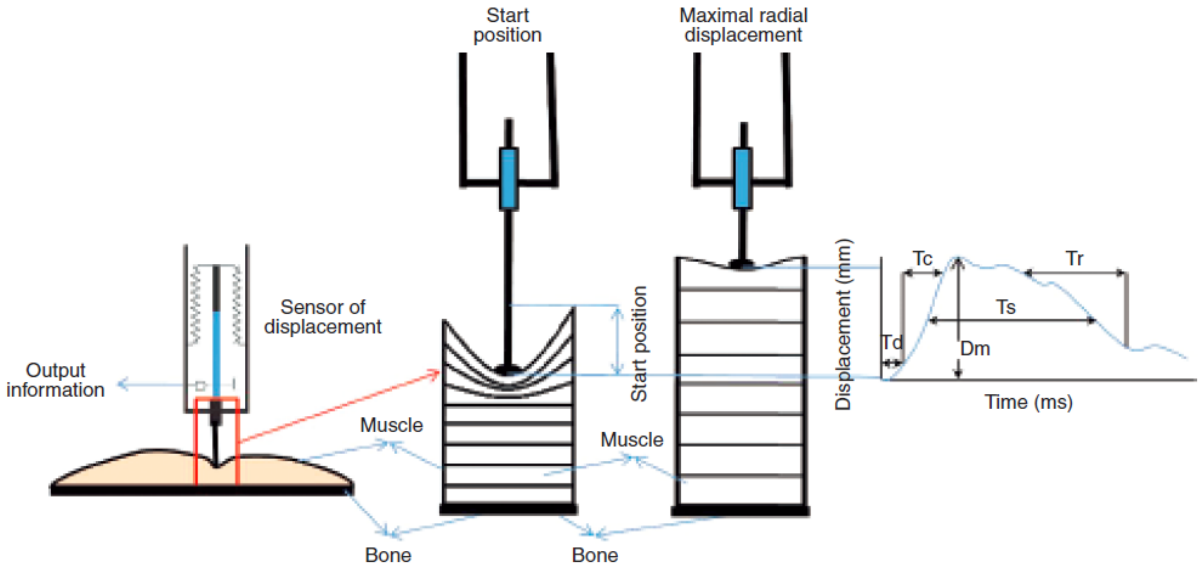
Tensiomyography



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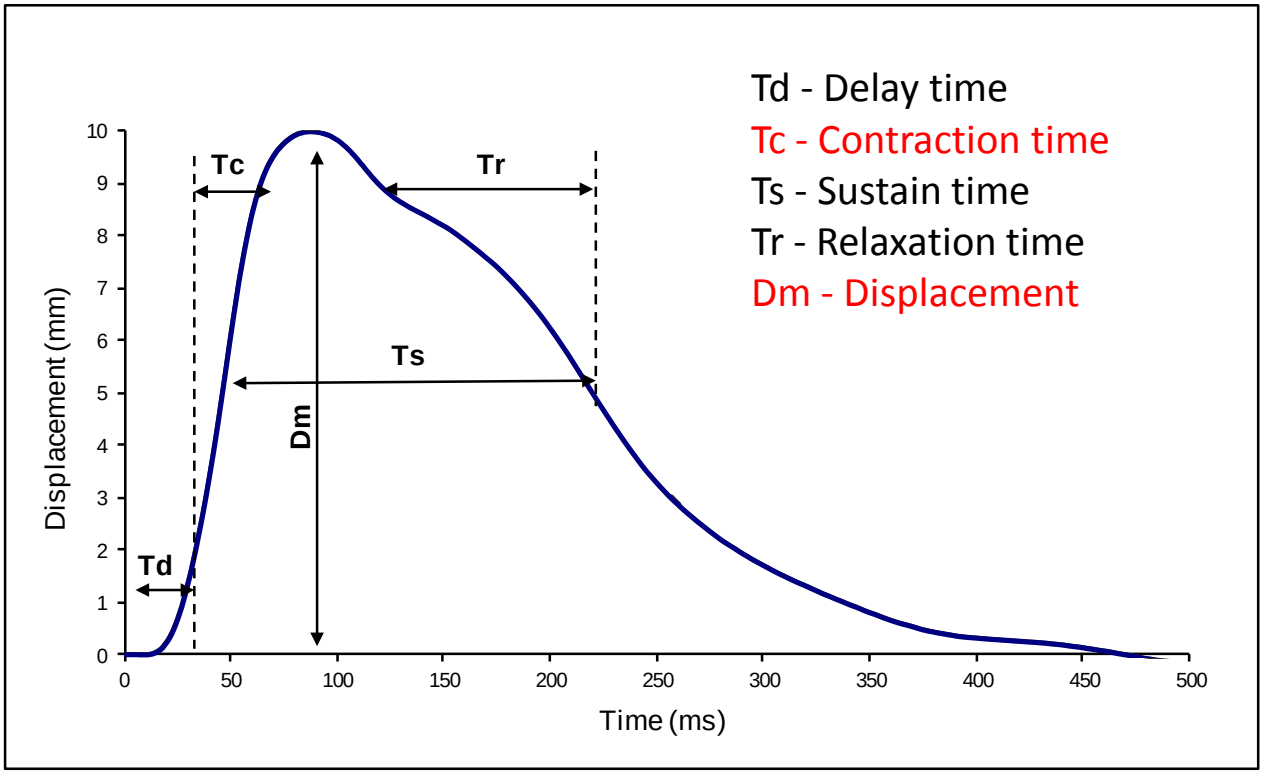
TMG Parameters



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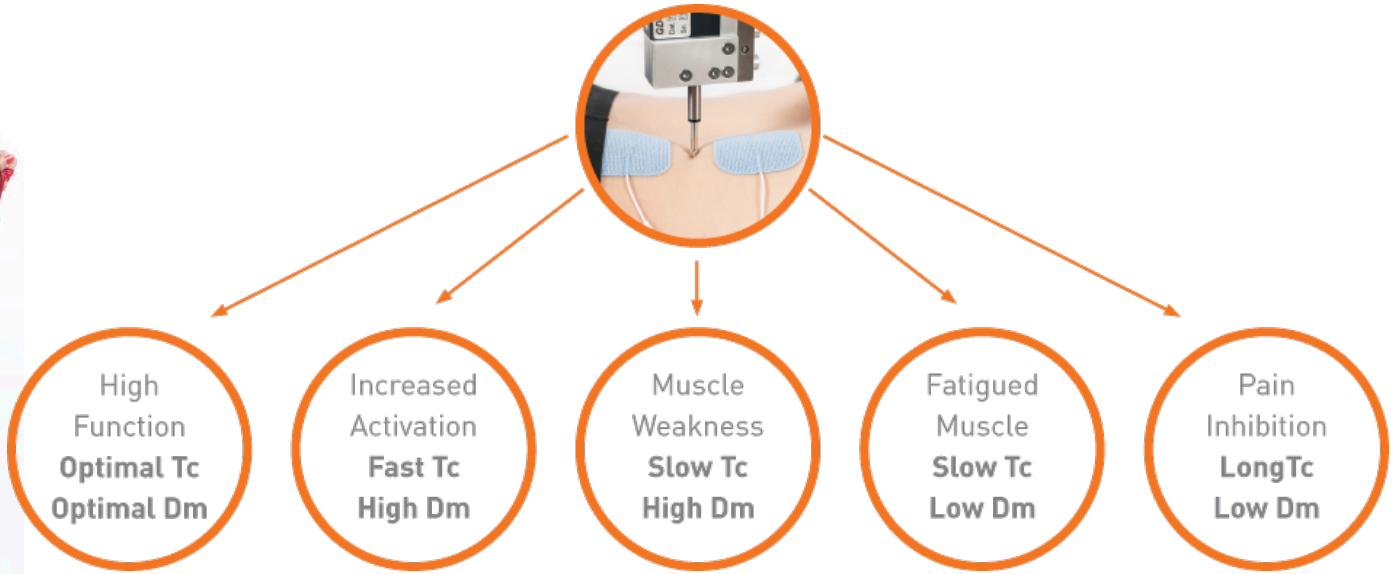
Muscle Response Scenarios



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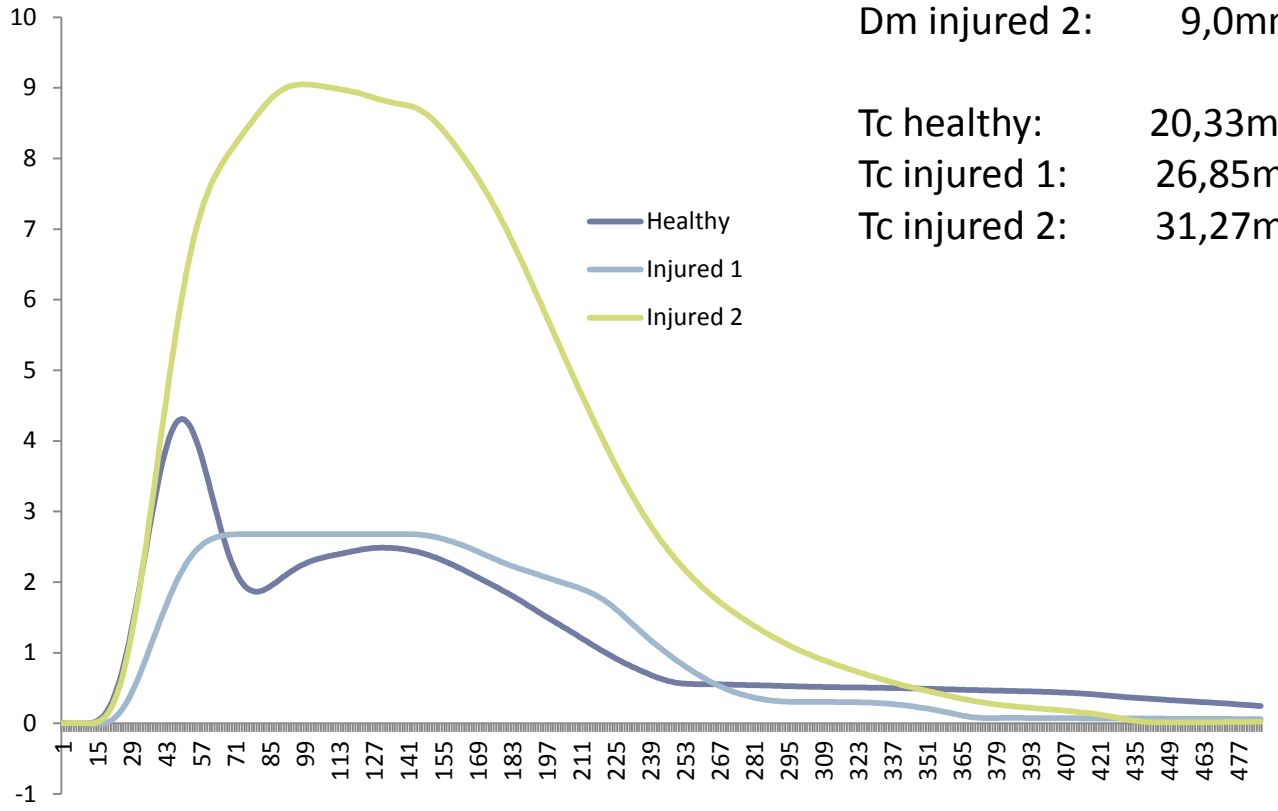
Sensitivity: raw data signals



Dm healthy:	4,3mm
Dm injured 1:	2,6mm
Dm injured 2:	9,0mm
Tc healthy:	20,33ms
Tc injured 1:	26,85ms
Tc injured 2:	31,27ms

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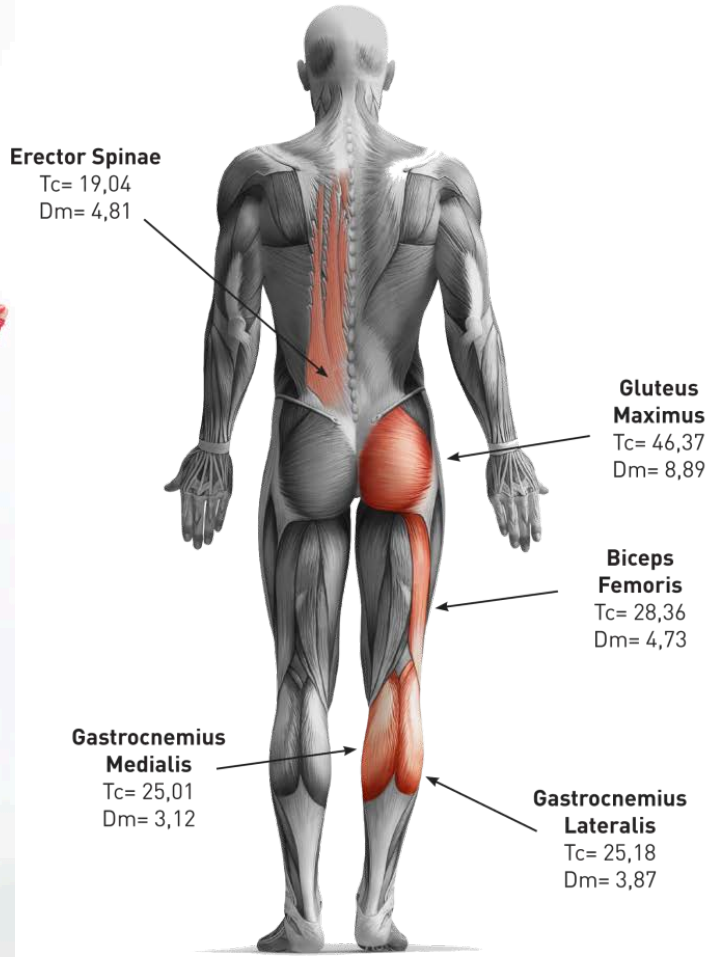
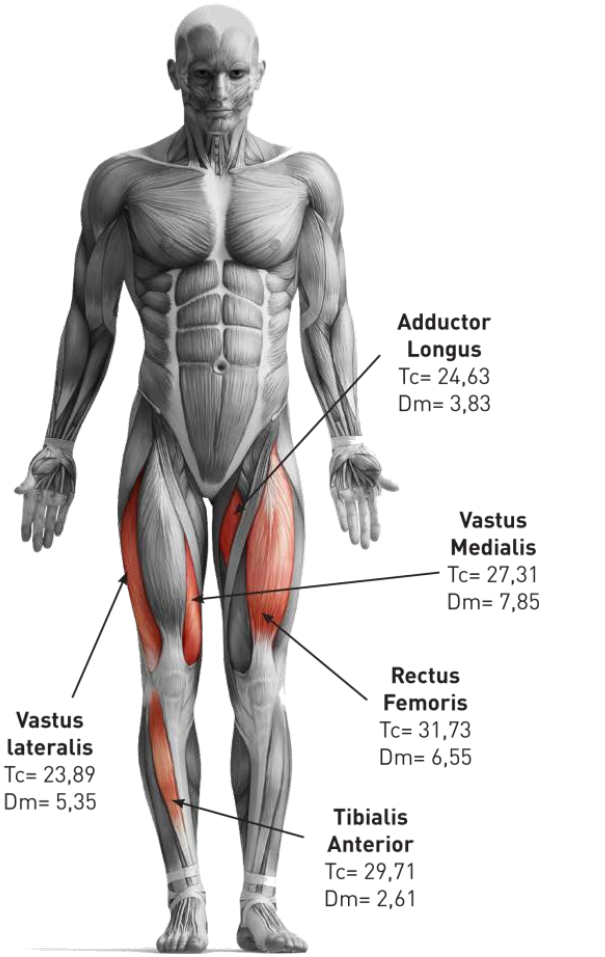
Reference database Male





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Basic Results

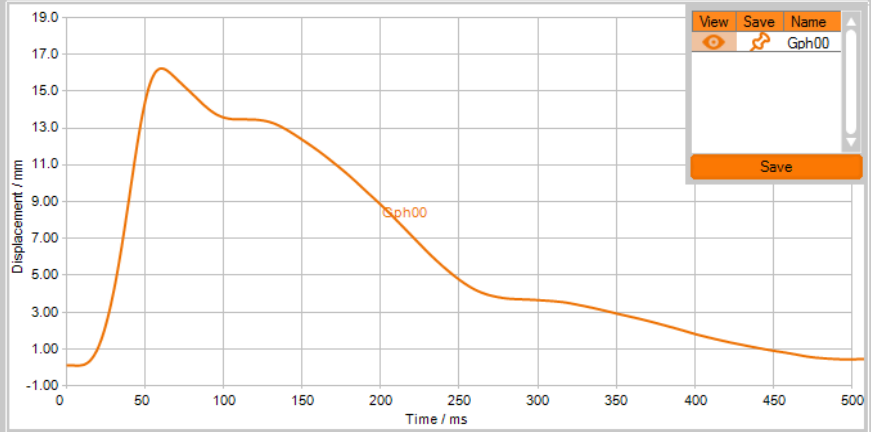
Subjects | Measurement | Import / Export | Reports | Options | Help

Characteristics

Subject	aaaa aaaa
Age	32
Height	11
Weight	11
Sport	Not defined
Diagnosis	Healthy
Comments:	

Edit

Measurement graph



Measurements

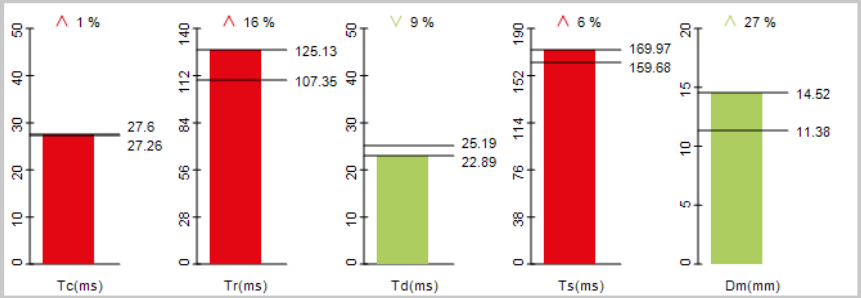
Muscle	Protocol	Side
BB - Biceps Brachii	protocol1	RIGHT

Edit

Measurement Current: 70.50

New Measurement | Generate Report

Characteristic Points



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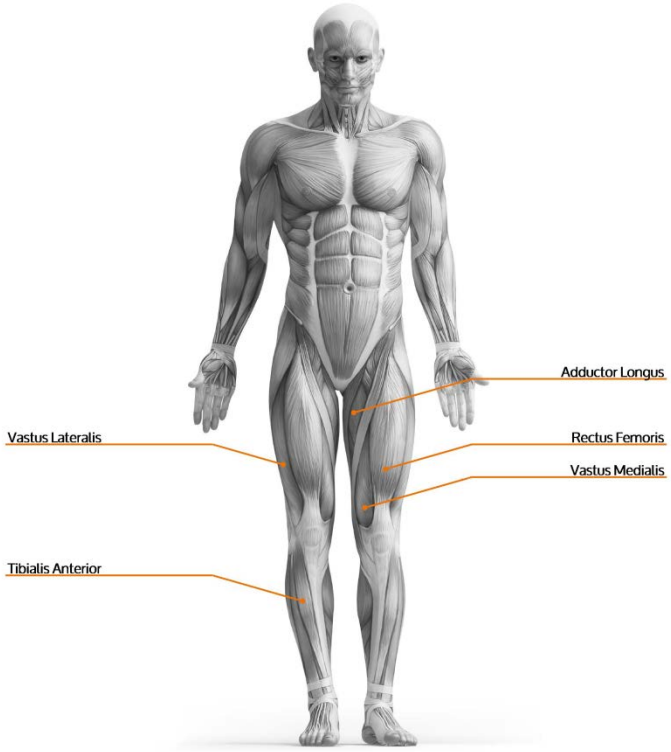
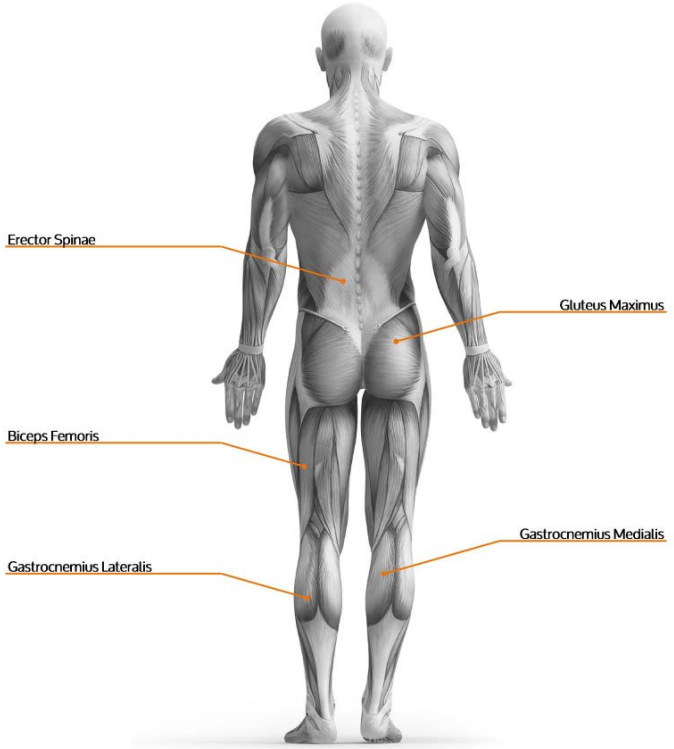
Lateral and Functional Symmetry

- Lateral Symmetry
- Functional Symmetry - Antagonistic Pairs
- Functional Symmetry - Synergistic Pairs





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Lateral and Functional Symmetry

Lateral Symmetry (LS)

Muscle	Side	Tc [ms]	Ts [ms]	Tr [ms]	Dm [mm]	Td [ms]	Sym [%]
m.BF	L	35.14	191.05	74.87	14.62	26.46	66
m.BF	R	24.15	219.19	30.52	5.37	23.23	
m.RF	L	23.44	135.17	65.52	11.25	21.62	79
m.RF	R	20.87	70.67	40.72	6.30	19.97	
m.ST	L	50.55	102.12	38.40	13.89	31.92	78
m.ST	R	42.47	151.20	44.31	8.92	24.52	
m.VL	L	23.72	179.47	152.13	11.00	23.72	89
m.VL	R	22.84	98.90	71.37	9.27	21.69	
m.VM	L	27.09	160.85	54.57	10.65	27.84	94
m.VM	R	28.41	177.89	84.22	10.28	23.14	

Functional Symmetry (FS)

		Sym [%]			Sym [%]
Elbow: (BB/TB)	L	--	Knee: (VL&VM&RF/BF)	L	74
	R	--		R	94
Achilles Tendon: (GL/GM)	L	--	Ankle: (TA/GL&GM)	L	--
	R	--		R	--
Lig.Patellae: (VM/VL)	L	88	Leg: (VL&VM/GL&GM)	L	--
	R	79		R	--

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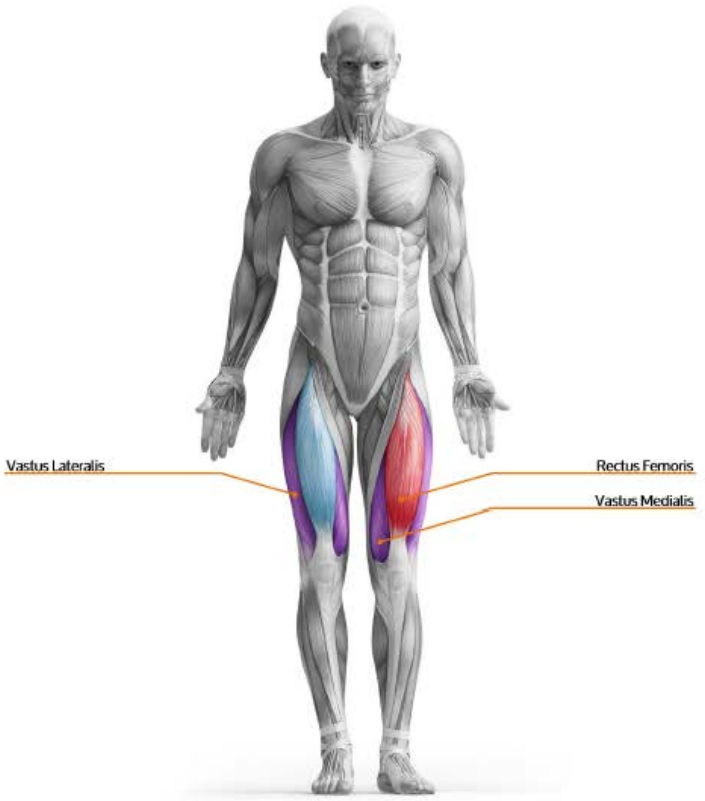
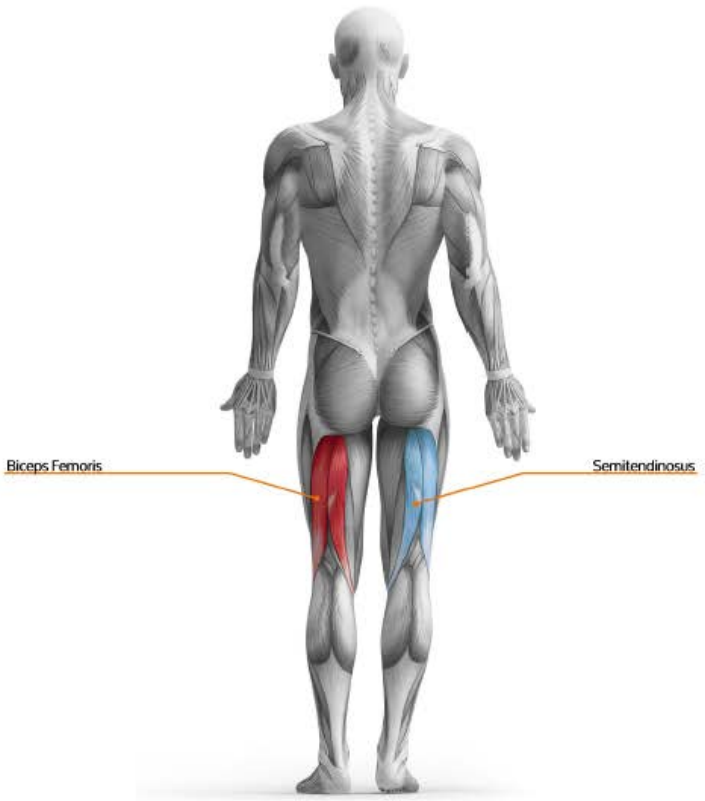
Comments / Recomendations





●Activation exercises ●Strength exercises ●Stretch / Relax

●Tc too slow ●Dm too high ●Dm too low

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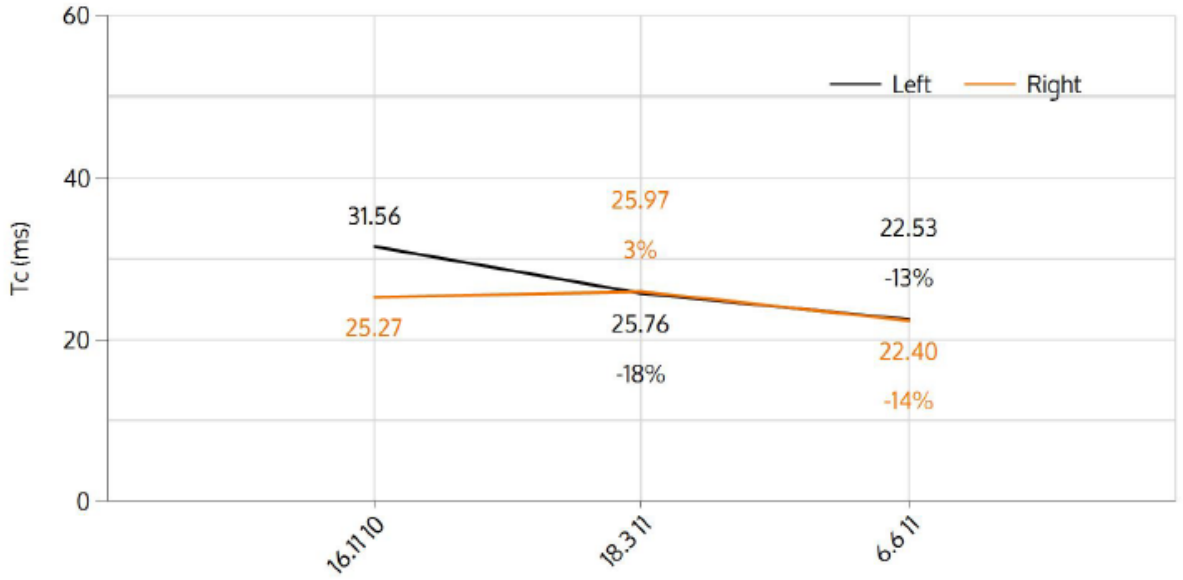
Rehabilitation Process Monitoring

Tc (Contraction time)

Date	Left	%	Right	%	Sym [%]
16.11.2010	31.56	0	25.27	0	80
18.03.2011	25.76	-18	25.97	3	99
06.06.2011	22.53	-13	22.40	-14	99



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MUSCLE INJURIES IN SOCCER

Designed by @YLMSportScience

About 2000 professional soccer players from 10 countries were followed between 2001 and 2010. Muscle injuries were registered prospectively by the club medical staffs. A muscle injury was defined as "a traumatic distraction or overuse injury to the muscle leading to a player being unable to fully participate in training or match play."

31%
of injuries in soccer are related to muscle injuries

92%
of all muscle injuries affected the 4 major muscle groups of the lower limbs: hamstrings (37%), adductors (23%), quadriceps (19%), and calf muscles (13%)

16%
of the muscle injuries were reinjuries

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X 2

increased rate of calf injury in older players, but no association was found in other muscle groups

on average, the number of muscle injuries sustained per player per season

15

muscles injuries expected per year for a squad of 25 players

References

Ekstrand et al. Am J Sport Med 2011
Hägglund et al. Am J Sport Med 2013

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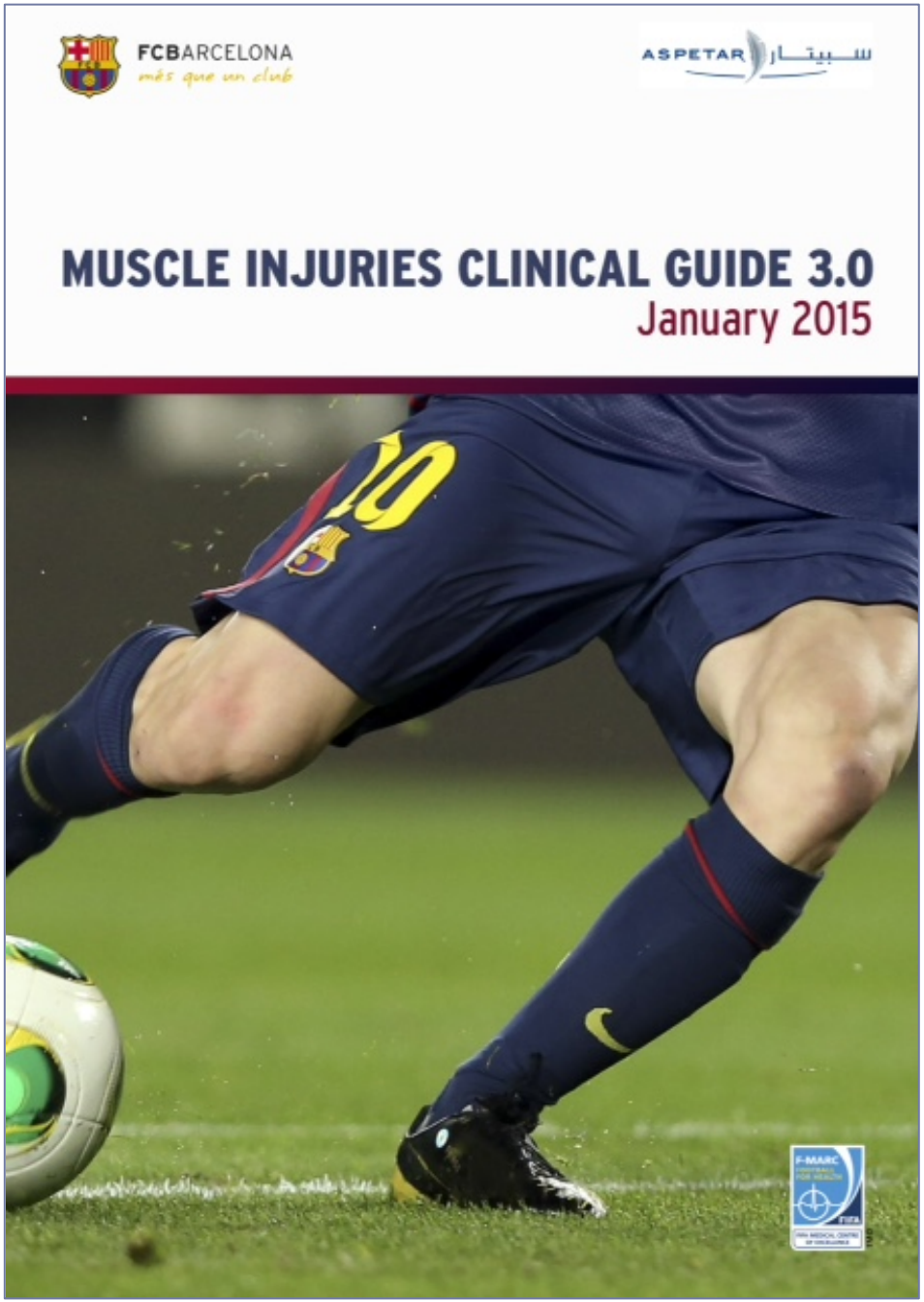

"Tensiomyography
is used for
follow-up the
functional recovery
of muscle
and to help decide
return to play"

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FC Bacelona & ASPETAR Example :

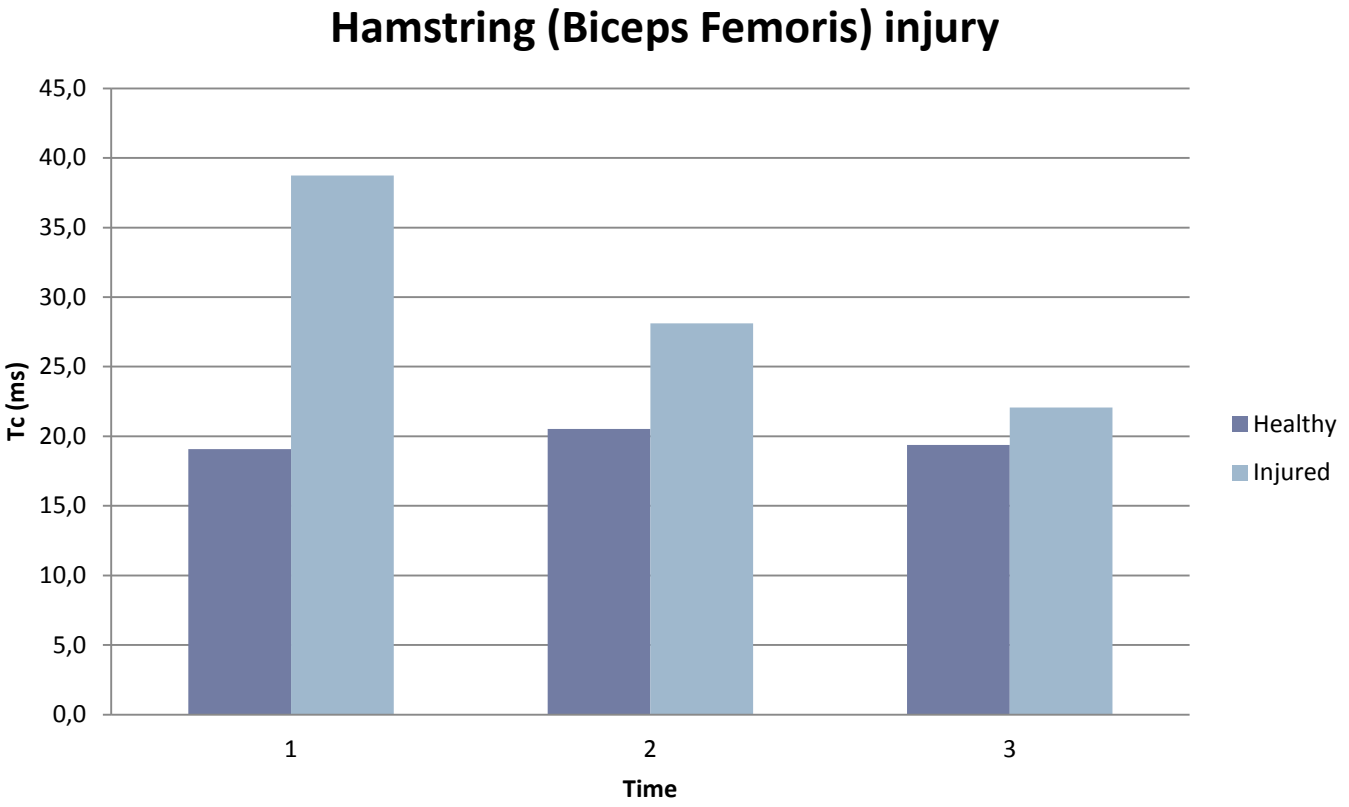
"Management of a muscle injury"

		Clinical history	Physical exam	US	MRI	Treatment
Initial acute phase	Immediate	X	X		Could be made anytime	**Rest Ice Compression Elevation Analgesia**
	12 hours		X	X		
	24 hours		X	X		
	48 hours		X	X		
					Functional tests	
Subacute and functional phase	1st week	Monitorize players feelings	X	x	To evaluate how the progression of loads are assumed	**Rehabilitation progressive protocol**
	Weekly		X	X		
	Return to play		X	X		

For follow-up the functional recovery and sometimes to help to decide return to play:

- *Muscle:* **Tensiomyography**, electromyography and strength tests.
- *Player:* GPS, HR and self administered scales during and after the rehabilitation sessions on field.

Rehabilitation Monitoring



1st measurement: 4 days after the injury
2nd measurement: 10 days after the injury
3rd measurement: 16 days after the injury

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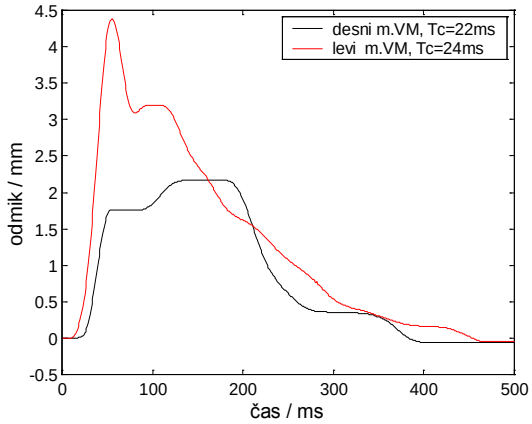
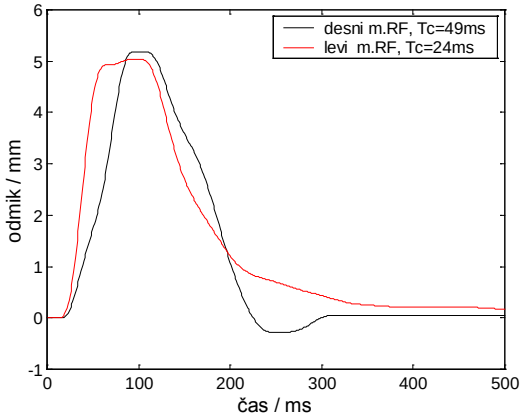
Knee Surgery - ACL

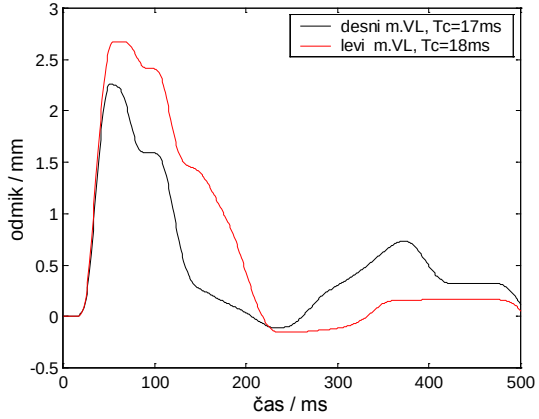
VM = 53 %



RF = 59 %



VL = 79 %



---- Healthy leg

---- Injured leg

4 days after the surgery
Patellar tendon graft

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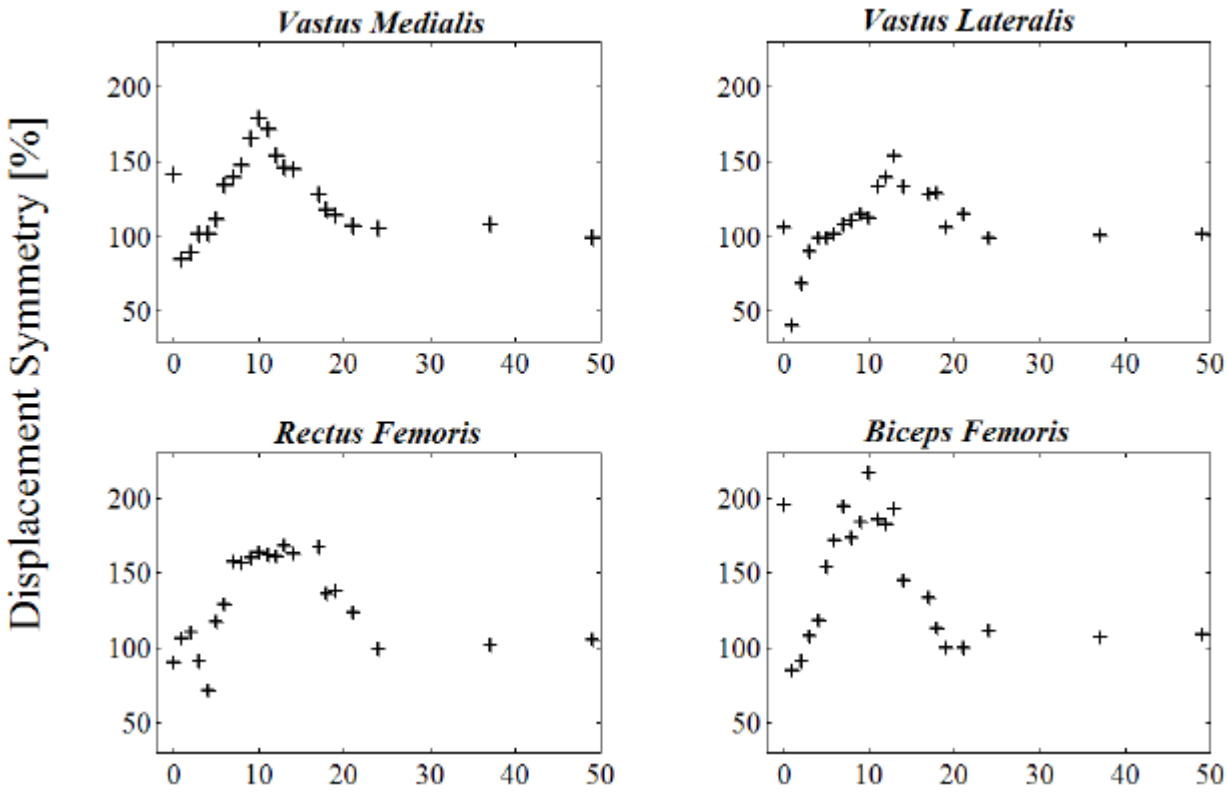
Recovery Monitoring – before/ after ACL surgery



Adaptation pattern to rehabilitation
Is different for each muscle

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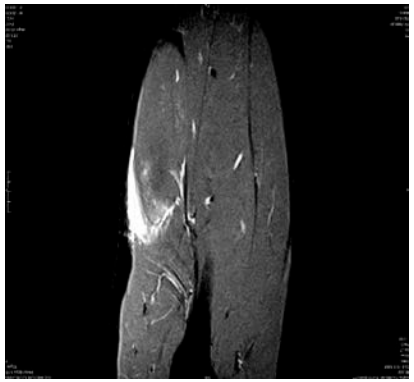
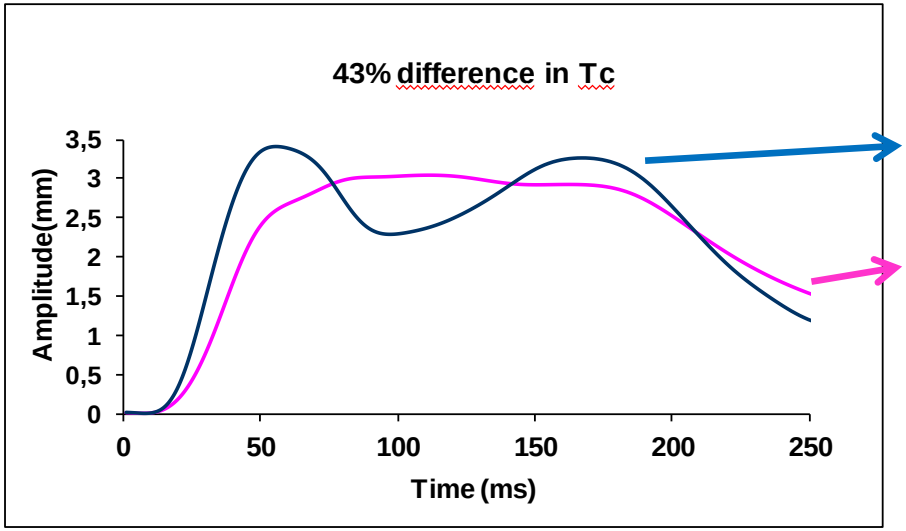
Other Diagnostic Methods

Hamstring (Biceps Femoris) injury





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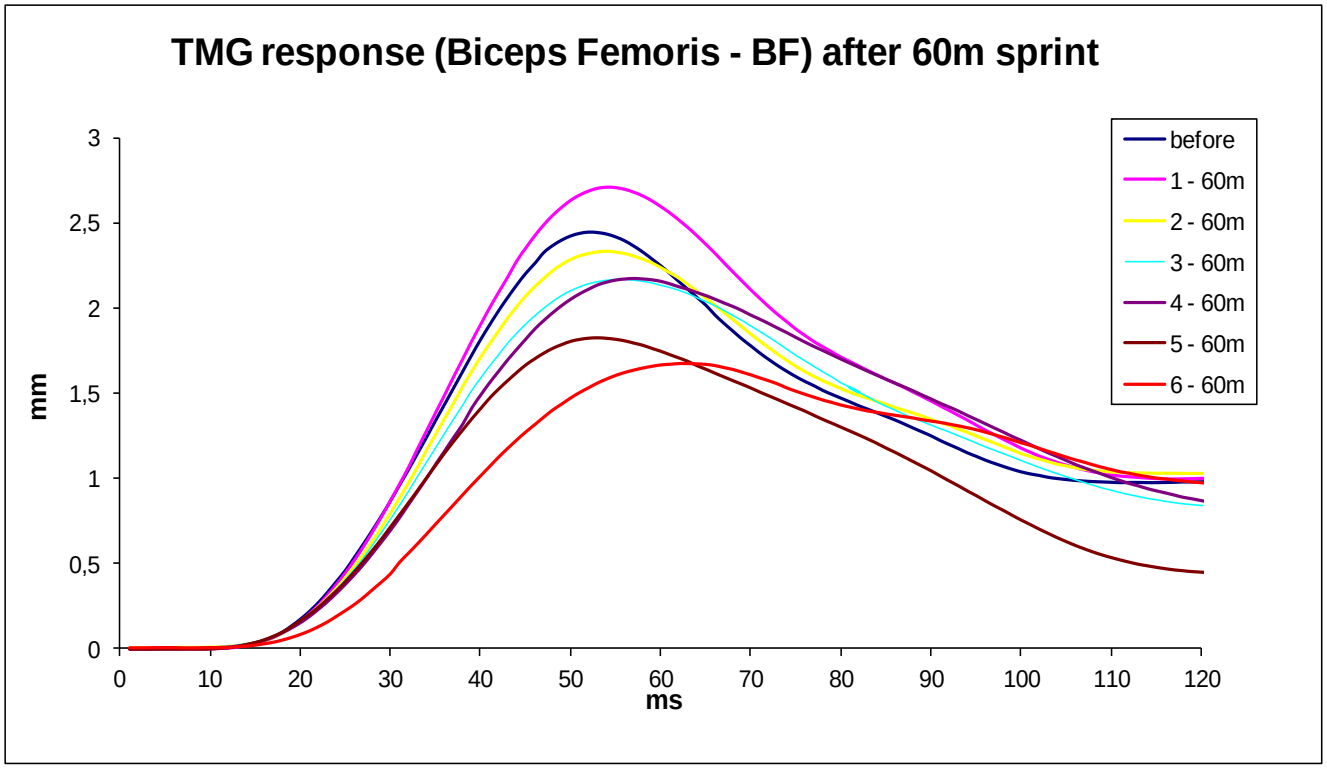
Muscle Fatigue Monitoring



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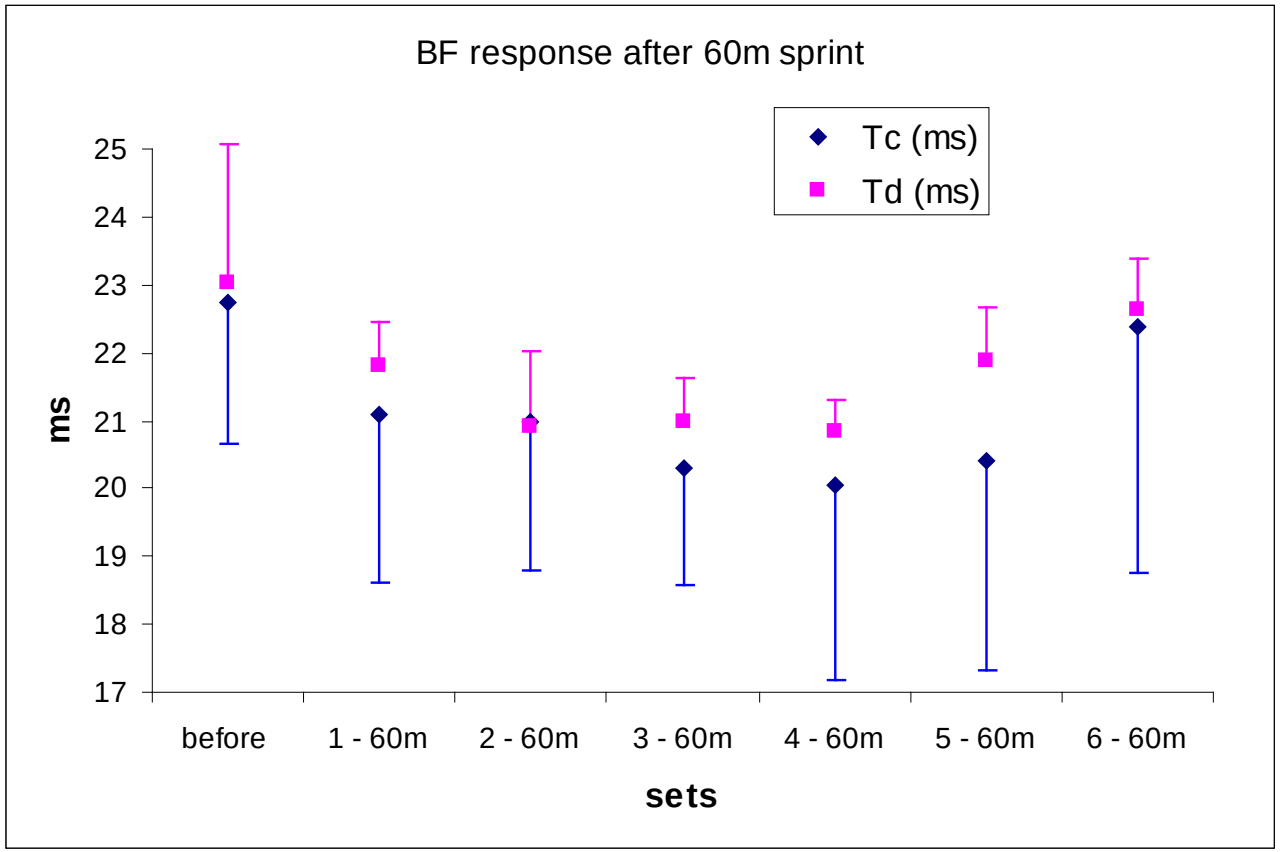
Muscle Fatigue Monitoring



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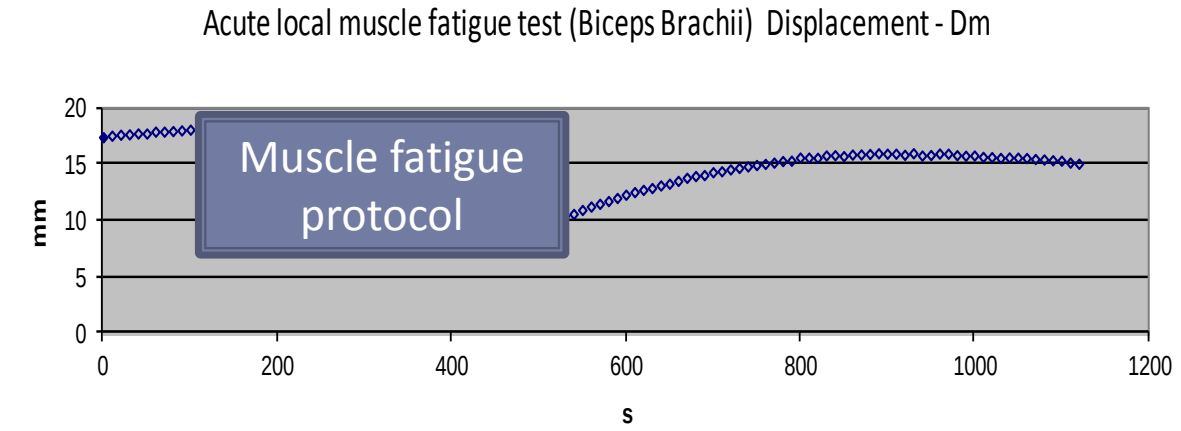
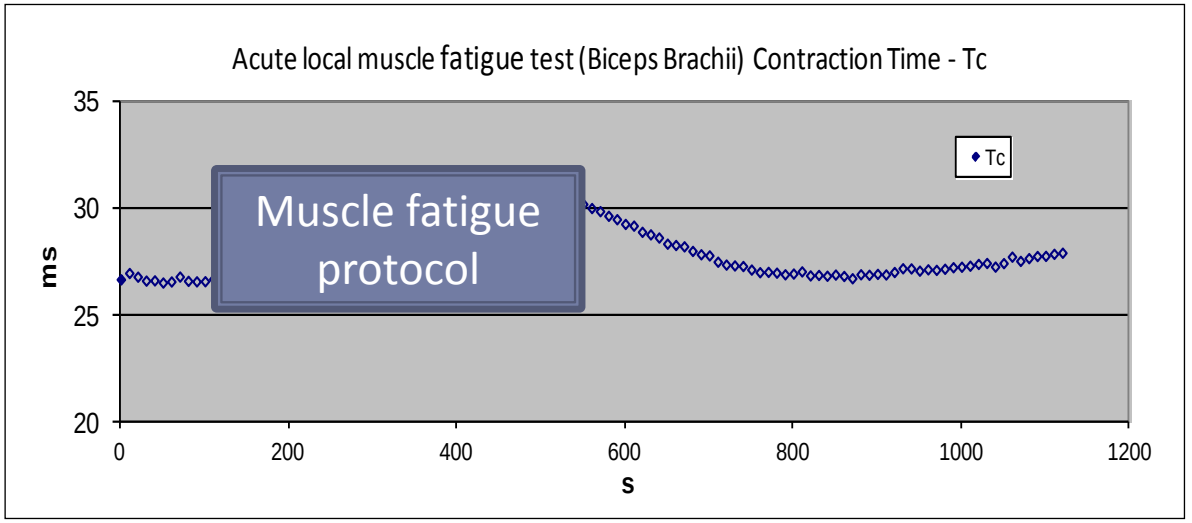
Muscle Recovery Monitoring





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Tensiomyography

Non-invasiveness (No conflict with rehabilitation process)

Selectiveness

Simplicity

High objectivity (no influence of motivation)

Immediate interpretation of results

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