Fatica centrale e periferica nella malatti neurologiche

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Paesi Bassi

Different kinds of fatigue!

UMC St Radboud

The different dimensions of fatigue and assessment tools

Type of fatigue	Methodology
Psychological	
Concentration	Subscale Checklist Individual Strength (CIS)
Restrictions in daily functioning	Abbreviated Fatigue Questionnaire (AFQ)
Physical activity	
Attributions about fatigue (e.g. attitude, self-efficacy)	
Social support	
Social functioning	
Psychological well-being	
Sleep disturbances	

Clinical neurophysiology of fatigue

M.J. Zwarts , G. Bleijenberg , B.G.M. van Engelen

Clinical Neurophysiology 119 (2008) 2–10

UMC St Radboud

The different dimensions of fatigue and assessment tools

Type of fatigue	
Physiological	*Methodology*
Central fatigue	Twitch interpolation
	Motor cortex stimulation
	Readiness potential
Peripheral fatigue	Force measurement (ergometer)
	Surface EMG
	Direct muscle stimulation

Clinical neurophysiology of fatigue

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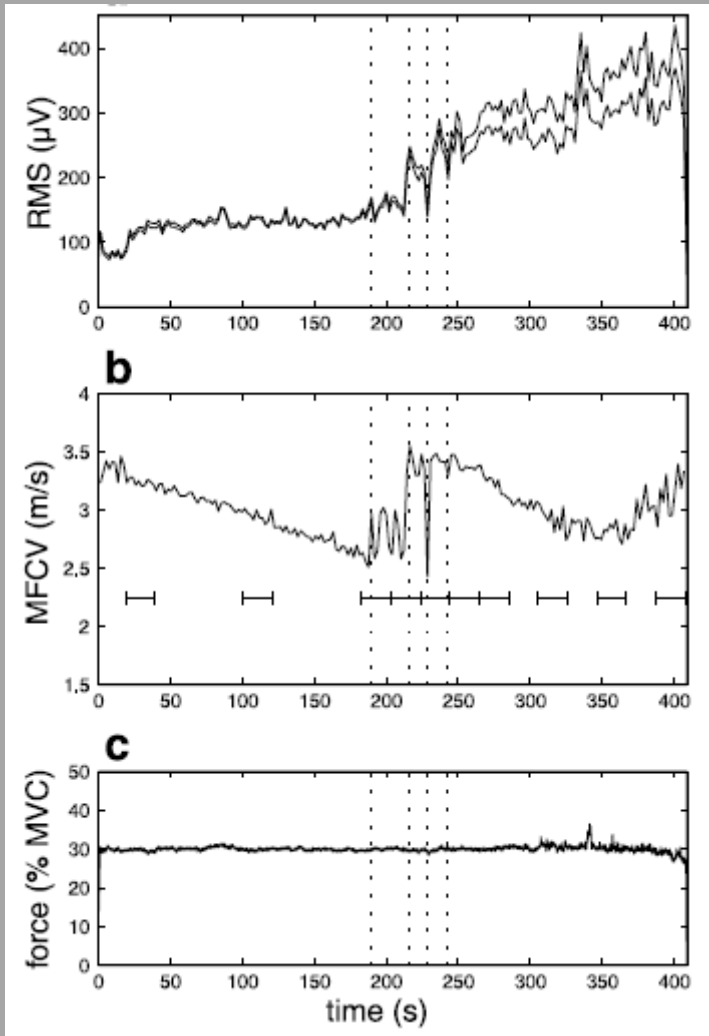
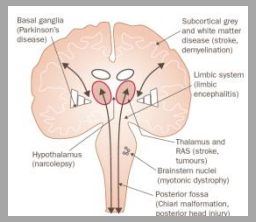
Fatigue has been defined as a time-related phenomenon of decline in the maximal force-generation capacity.

Usually, this is expressed by a deterioration in maximal voluntary contraction (MVC).



Houtman, C. J., D. F. Stegeman, J. P. Van Dijk, and M. J. Zwarts. Changes in muscle fiber conduction velocity indicate recruitment of distinct motor unit populations. *J Appl Physiol* 95: 1045–1054, 2003.



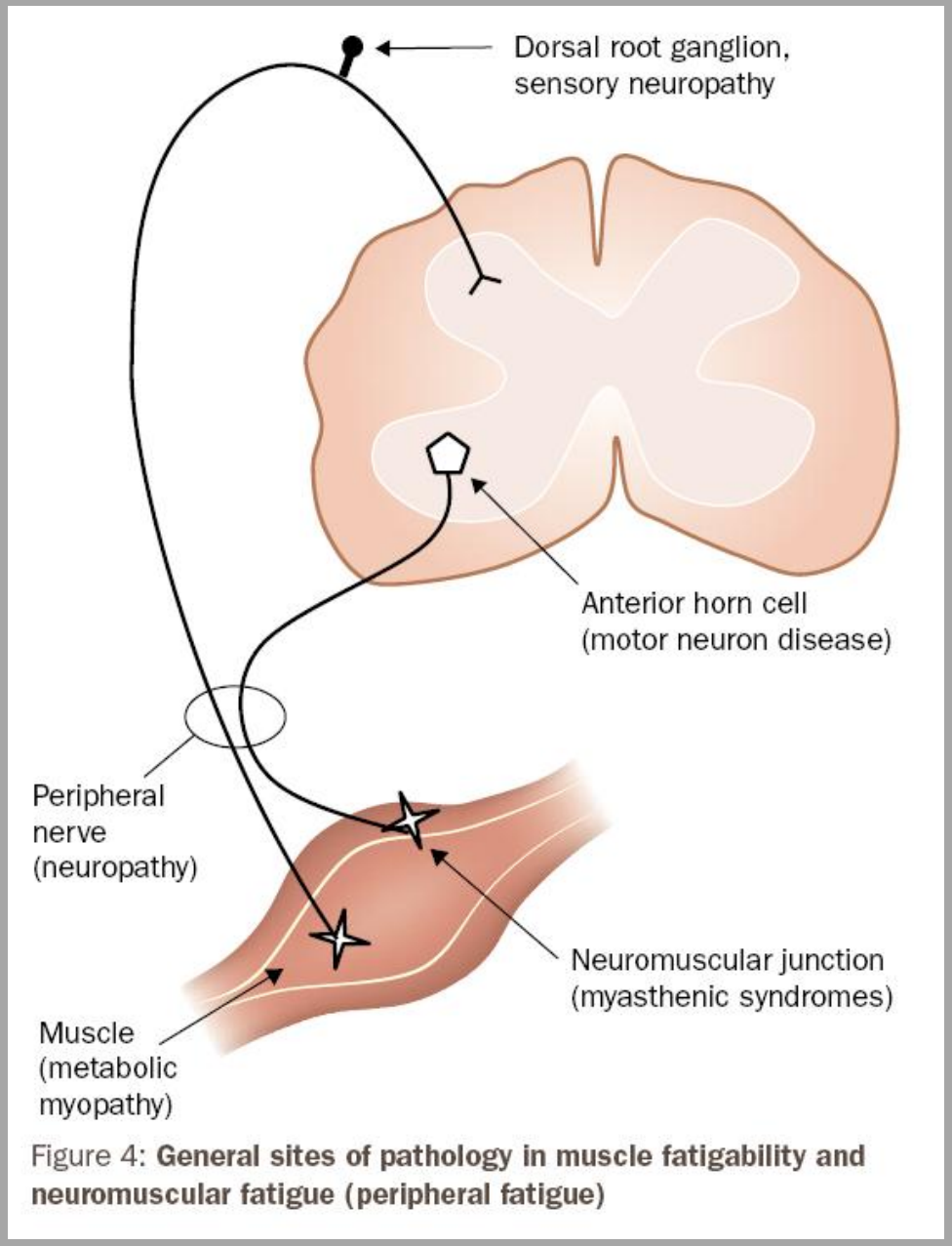


Figure 4: **General sites of pathology in muscle fatigability and neuromuscular fatigue (peripheral fatigue)**

Review

Fatigue in neurological disorders

Abhijit Chaudhuri, Peter O Behan

Lancet 2004; **363**: 978–88

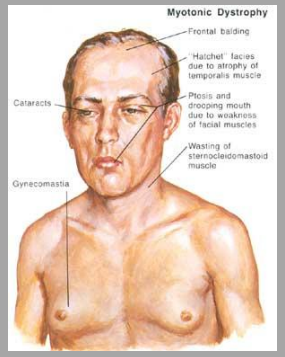
Multidisciplinair research

Three neuromuscular disorders:

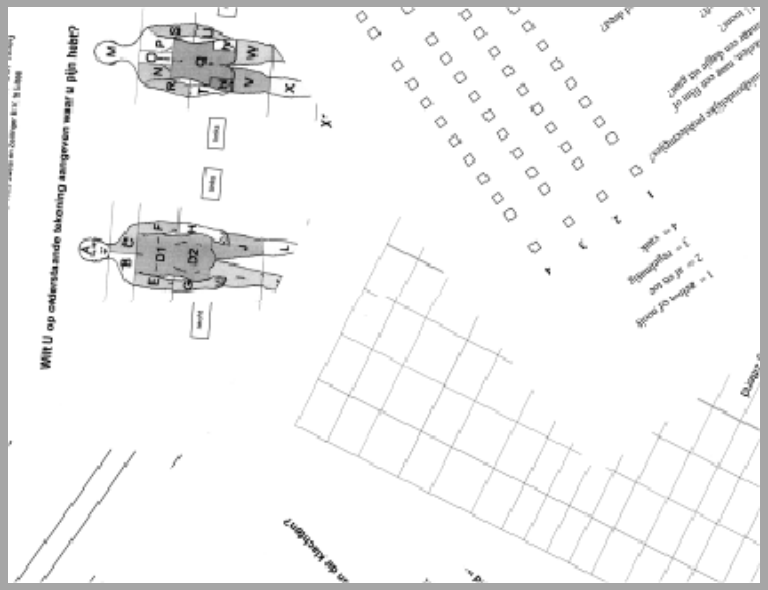
Muscle – FSHD

Nerve – HMSN I

Multisystem - MD

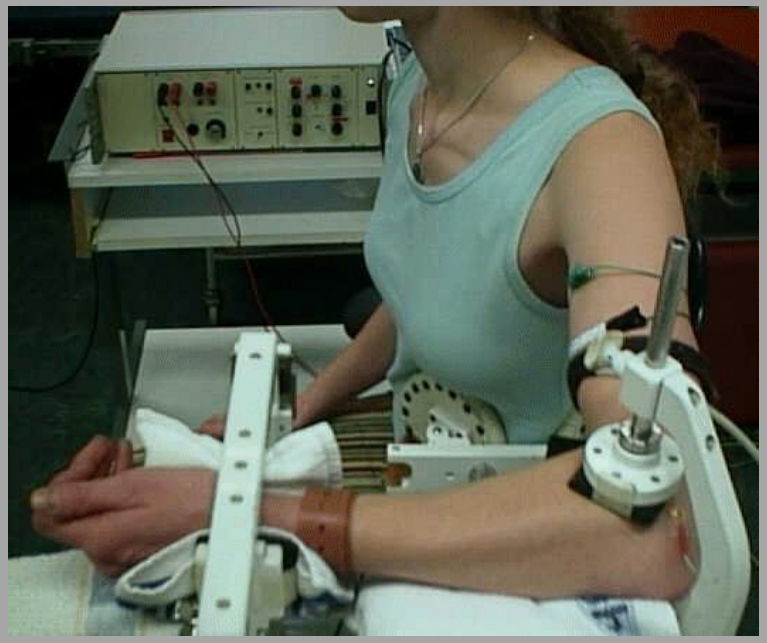


Experienced fatigue

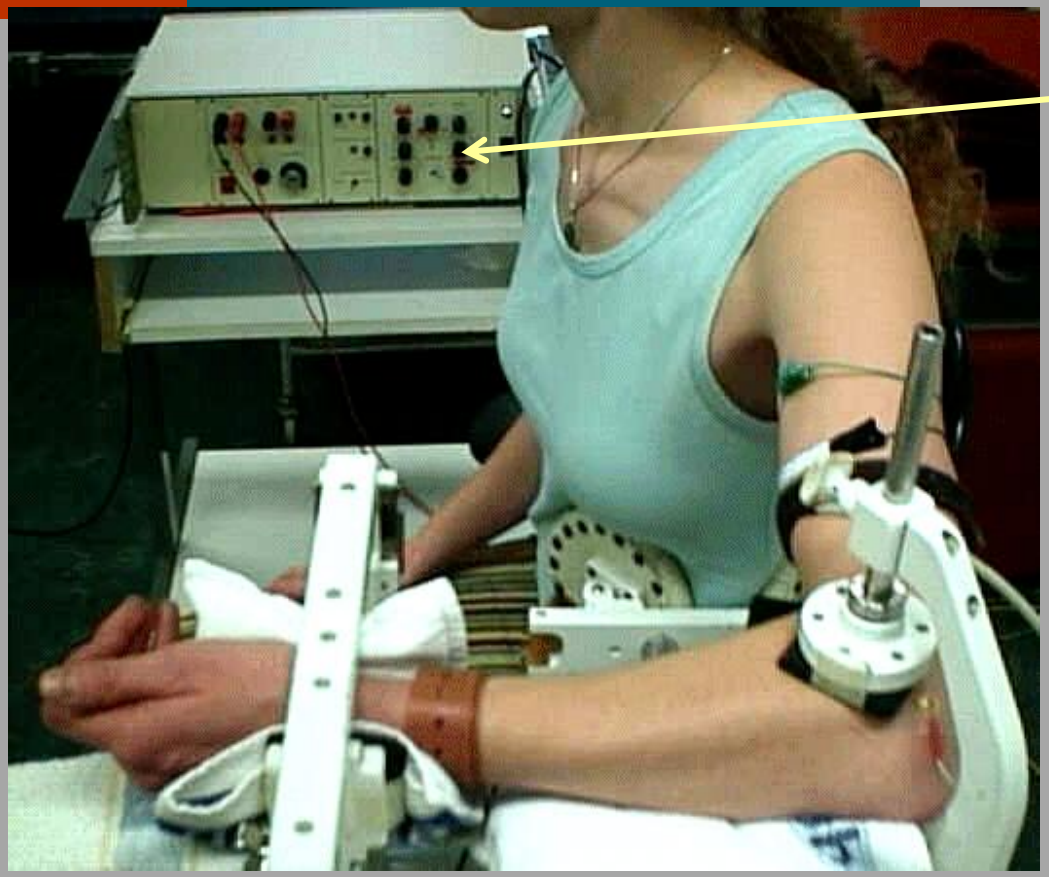


Questionaires

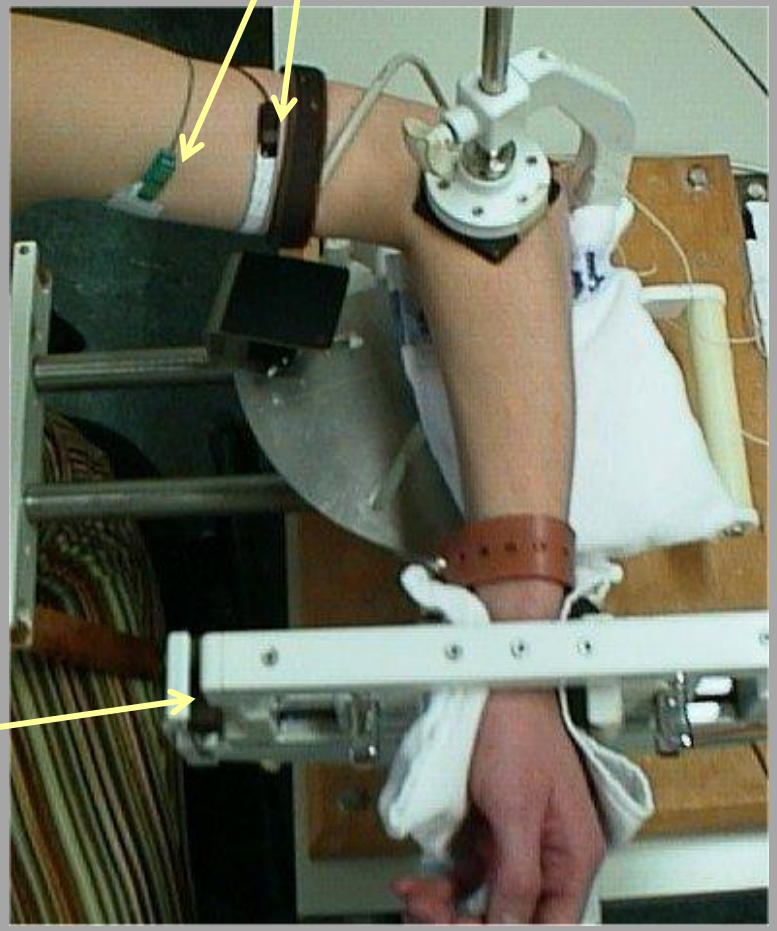
Physiological fatigue



Elektrophysiological changes over time

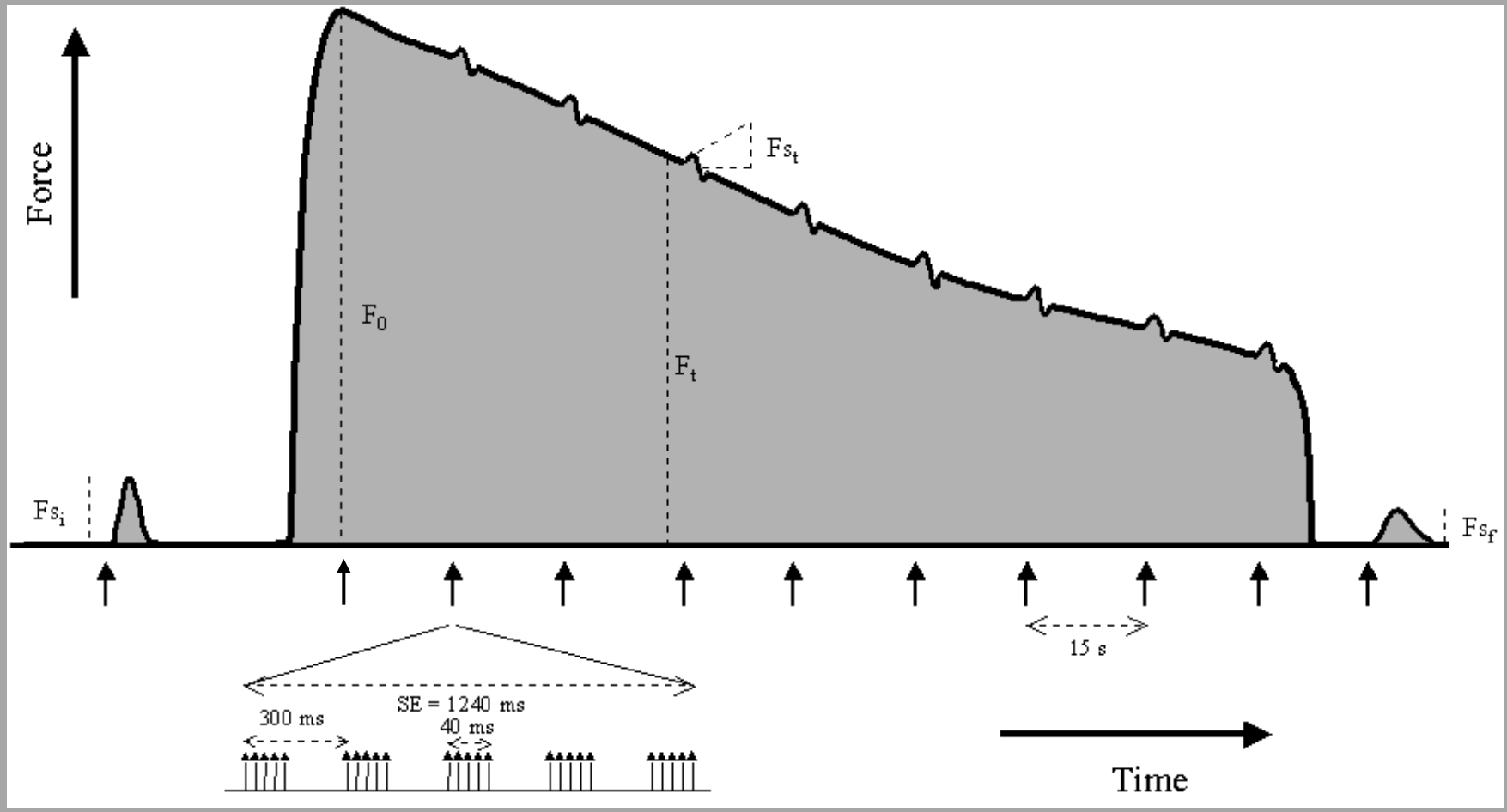


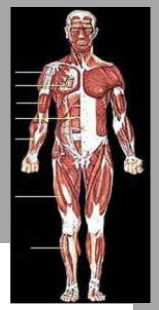
Stimulation-electrodes



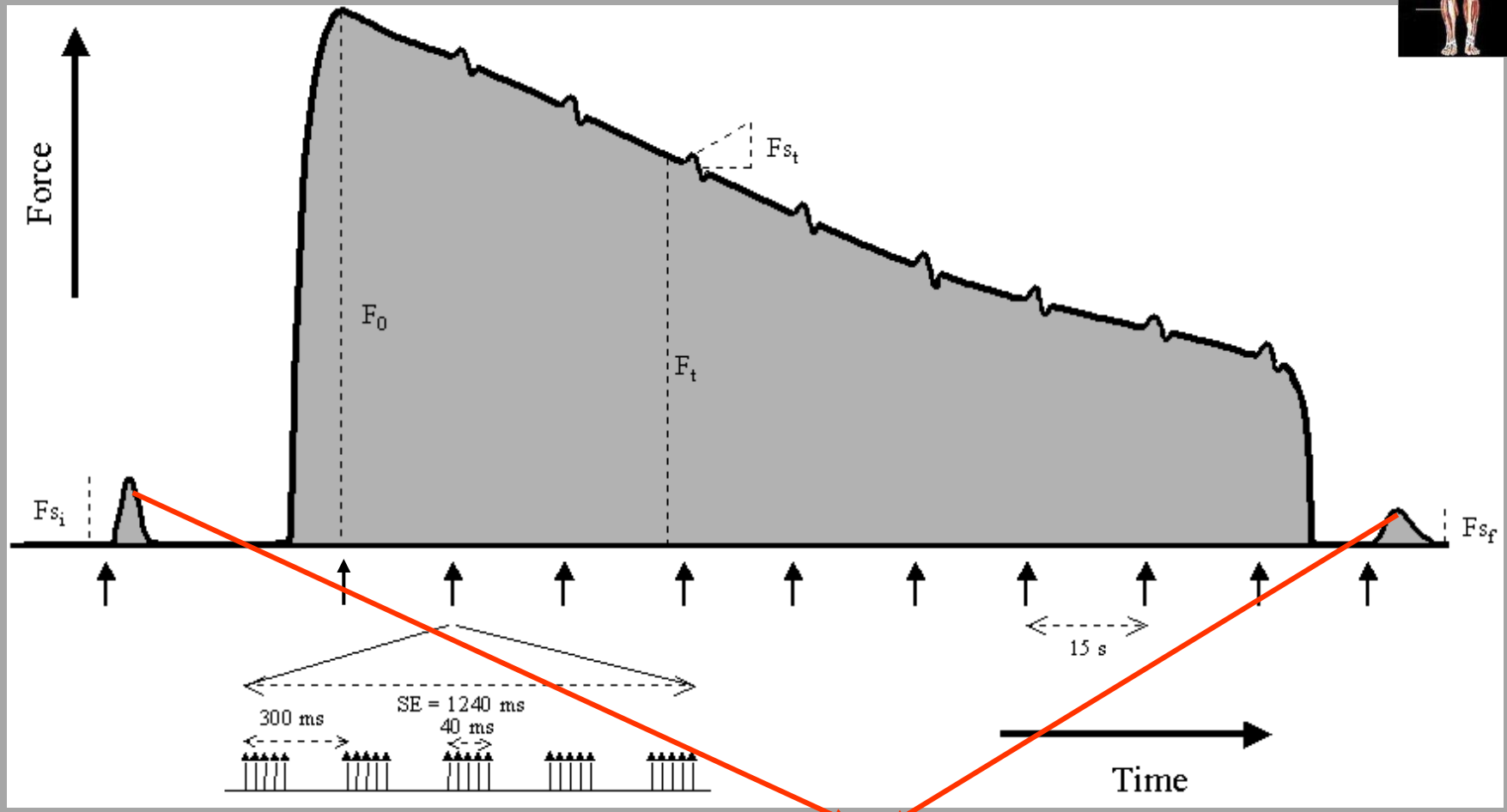
Elektrophysiological measurement: twitch interpolation

2 min. maximal voluntary contraction

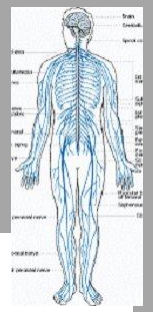




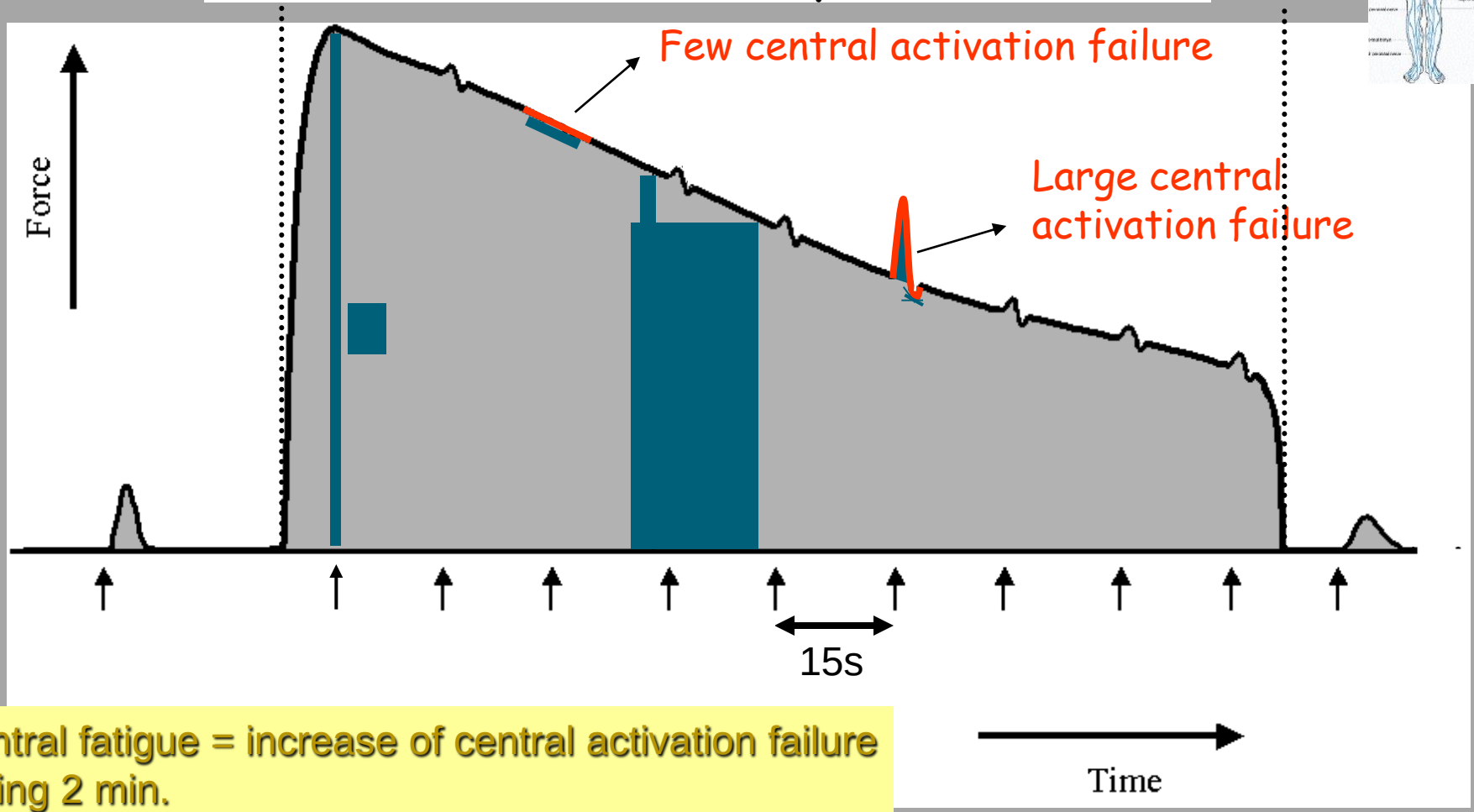
2 min. maximal voluntary contraction



Peripheral fatigue

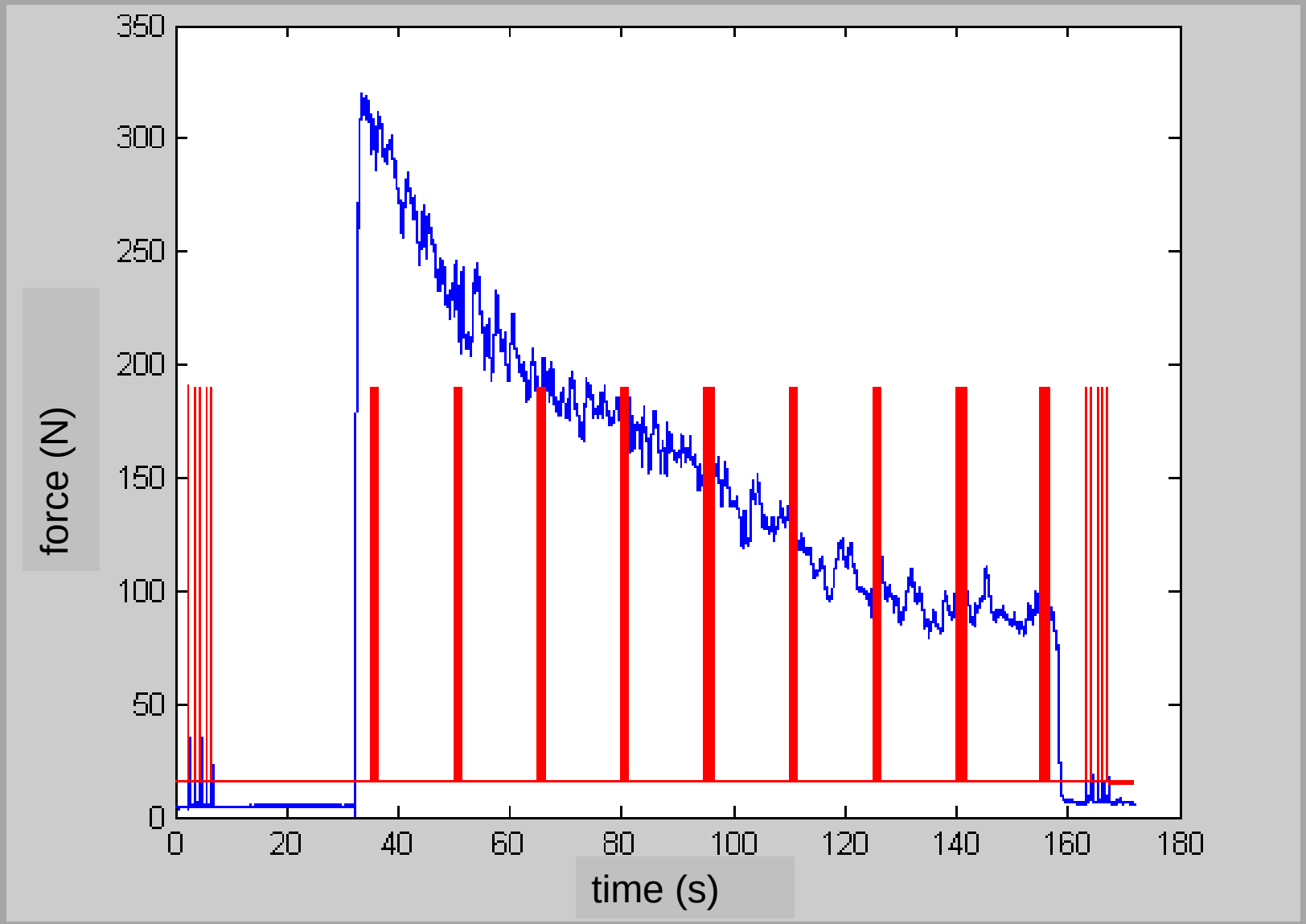


2 min. maximal voluntary contraction



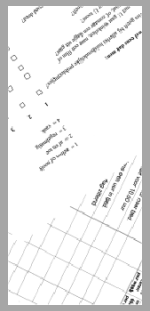
Central fatigue = increase of central activation failure during 2 min.

Average central activation failure indicates amount of central drive


force (N)
time (s)
0
50
100
150
200
250
300
350
0
20
40
60
80
100
120
140
160
180

Participants

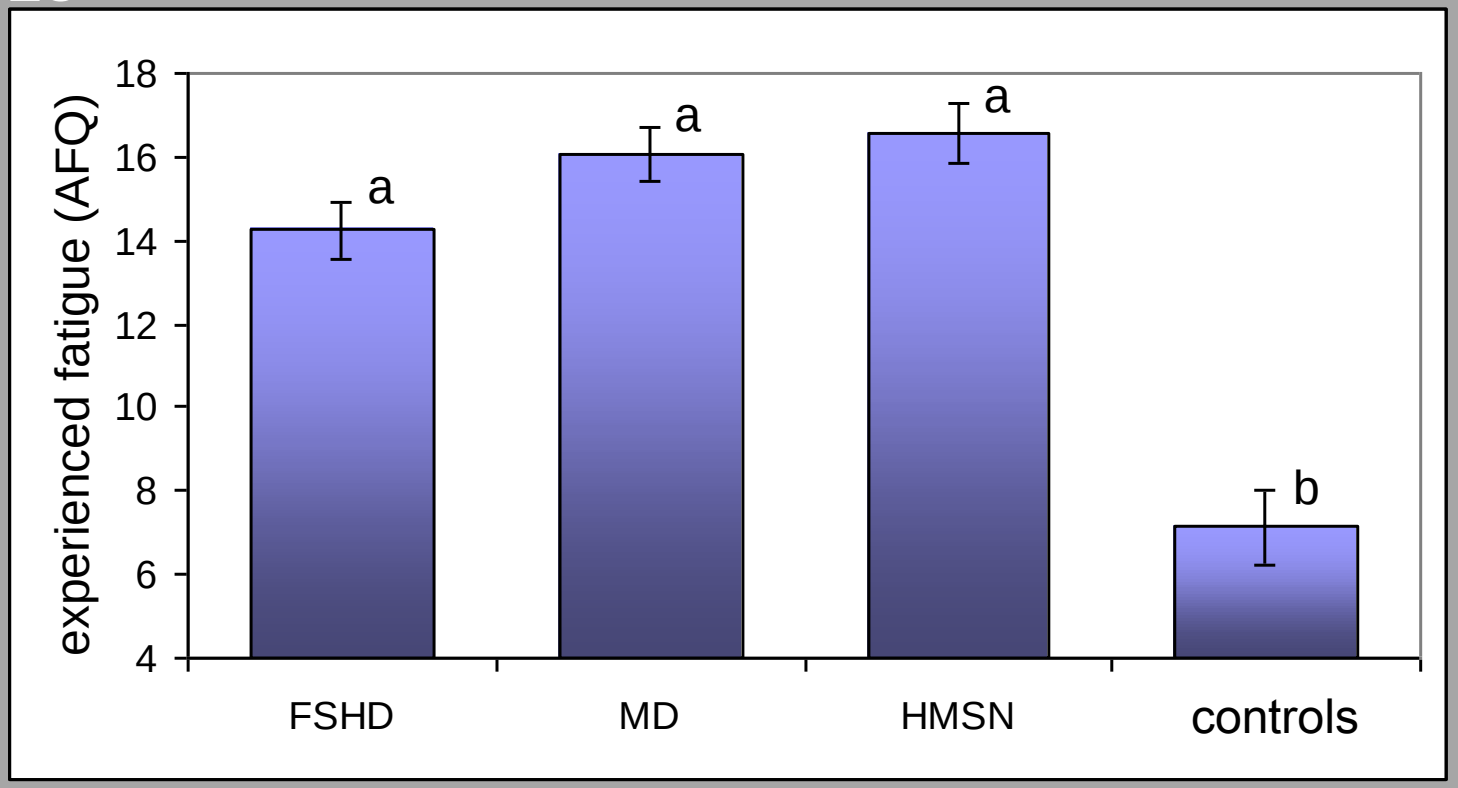
65 FSHD	age 43.1 (10.3)	♀ : 27, ♂ : 38
79 MD	age 41.0 (9.8)	♀ : 35, ♂ : 44
73 HMSN	age 42.4 (9.8)	♀ : 43, ♂ : 30
24 controls	age 42.1 (13.5)	♀ : 12, ♂ : 12

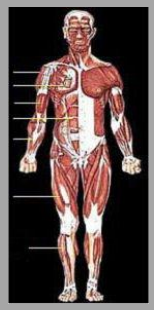


result 1:

More than 60% of all patients experience extreme fatigue!

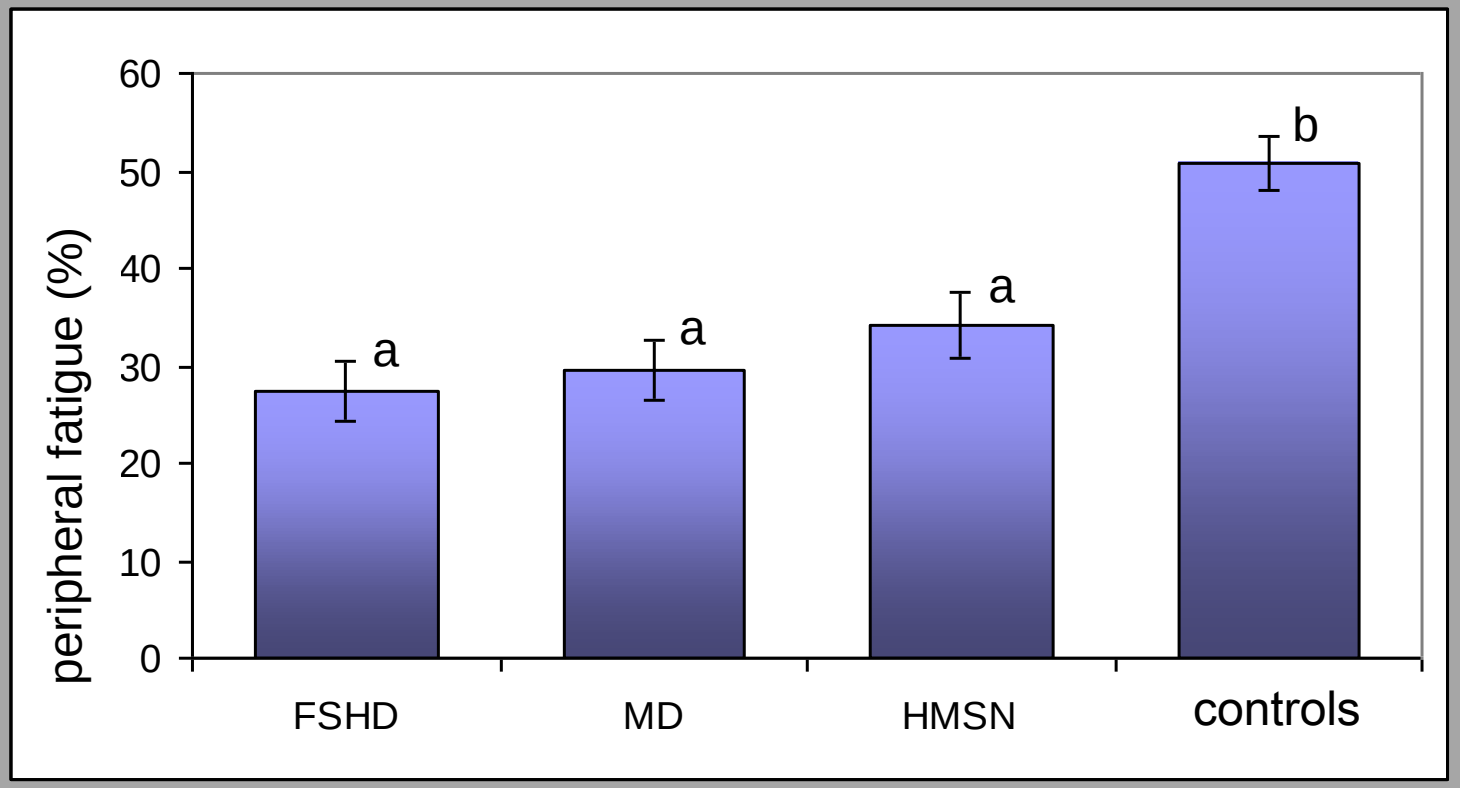
Abbreviated Fatigue Score (AFQ): scores range from 4-28

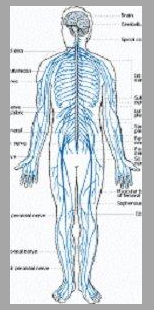




result 2:

Peripheral fatigue

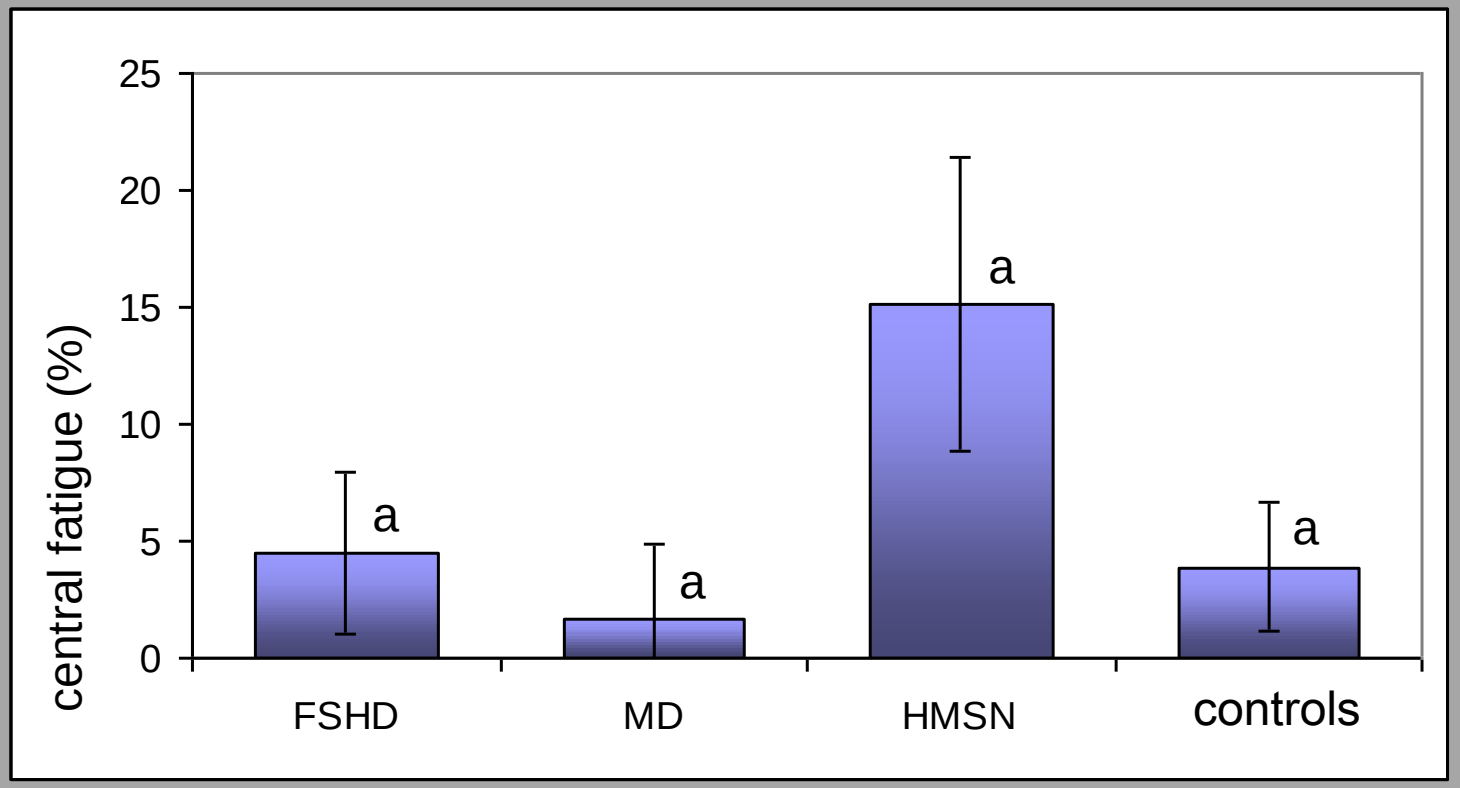


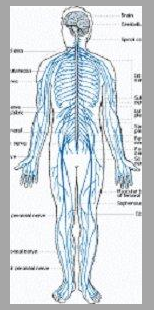


Central

result 3:

Central fatigue

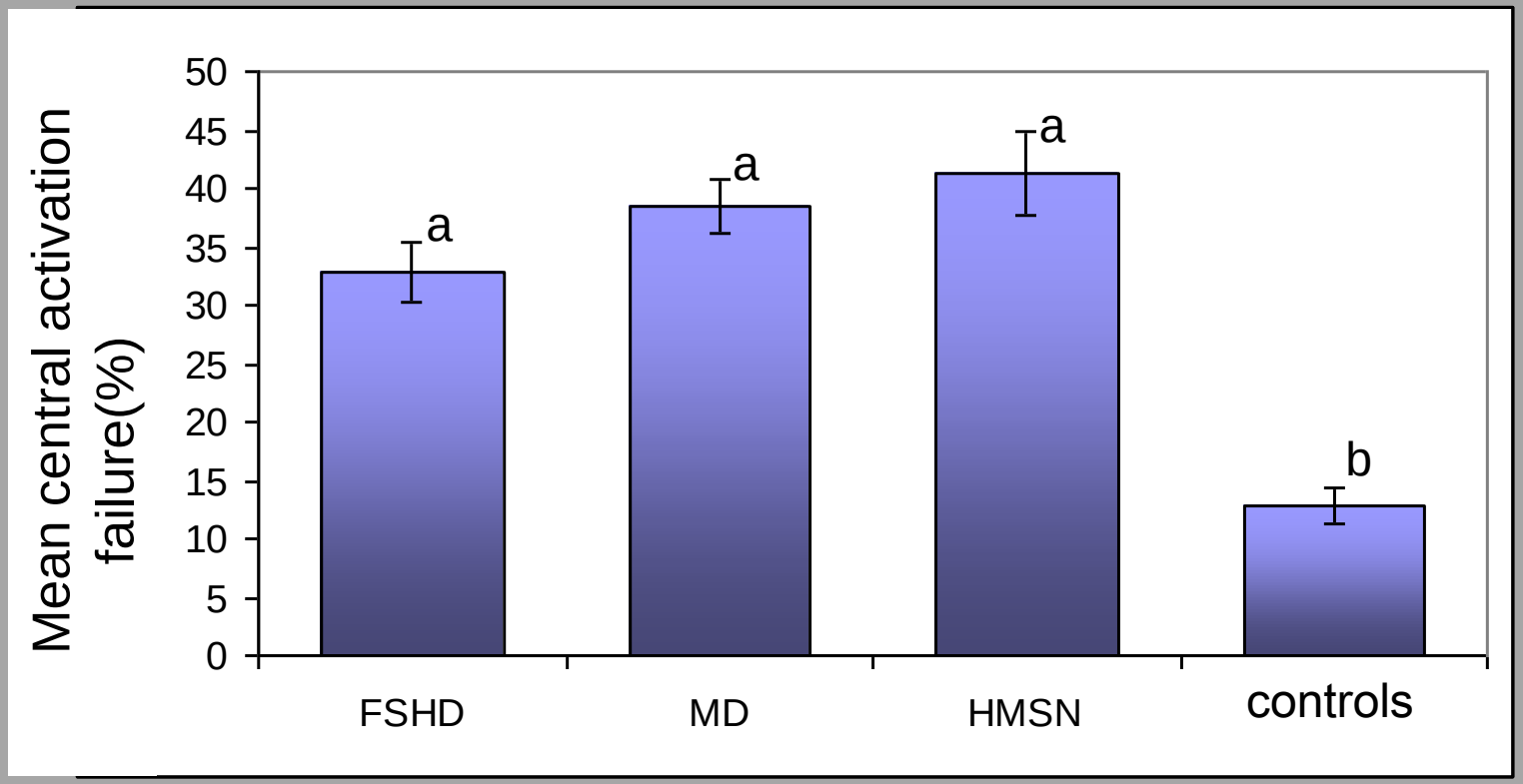




Central

result 4:

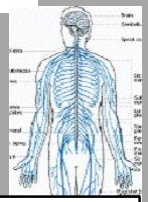
Central drive

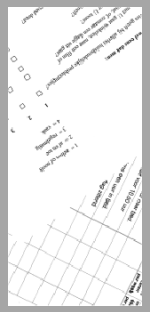


Neuromusculair patients:

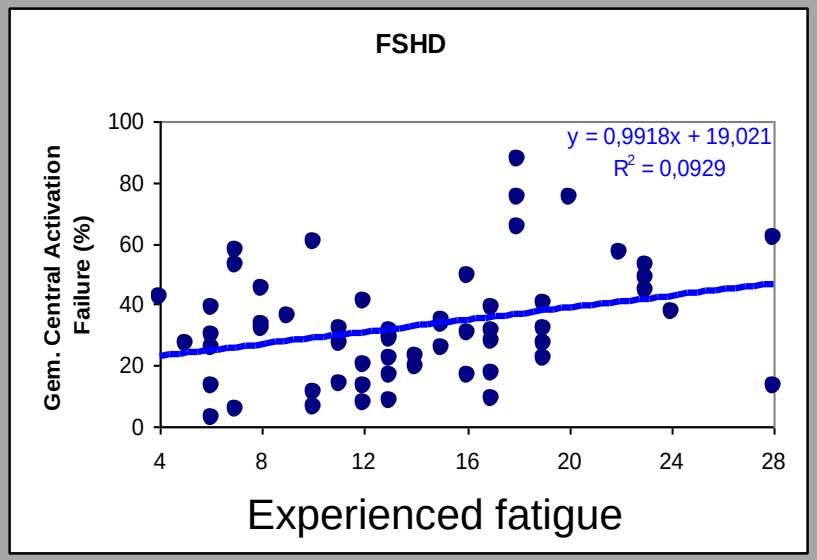
- Large experienced fatigue
- Small peripheral fatigue
- Normal central fatigue
- Strongly diminished central drive

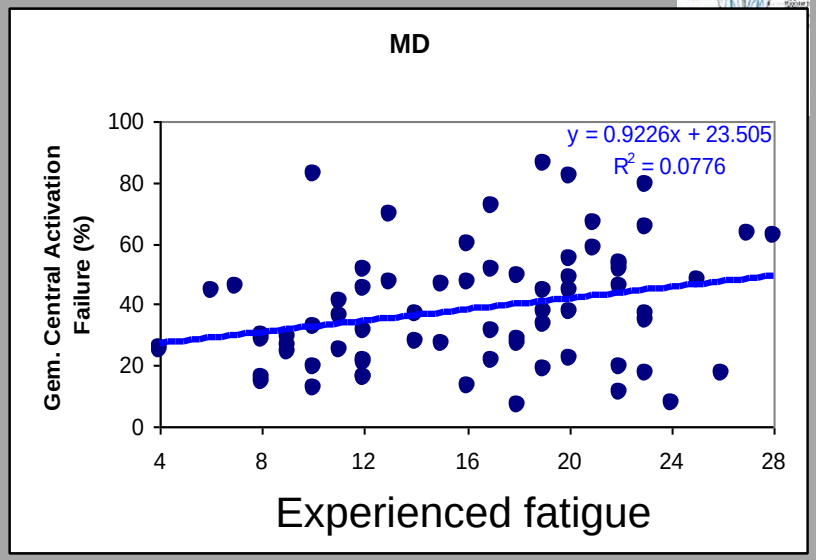
Which physiological measure is related to the large experienced fatigue (if any)?

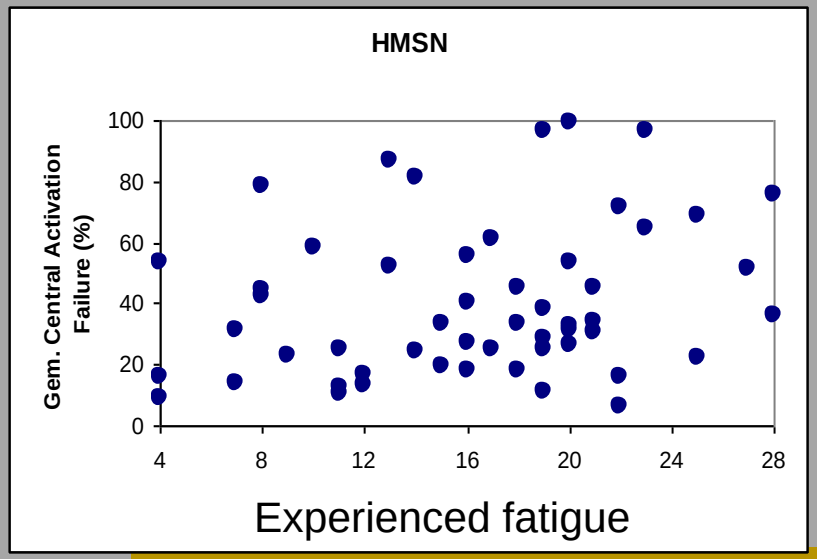


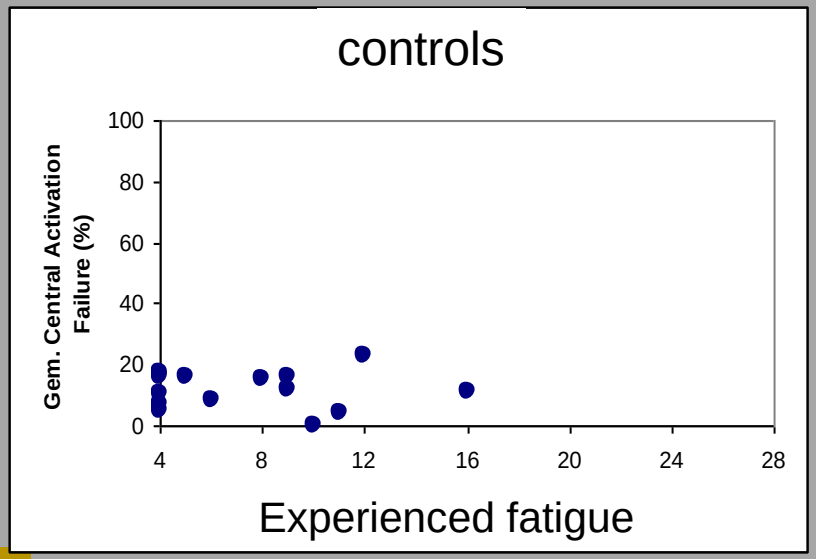


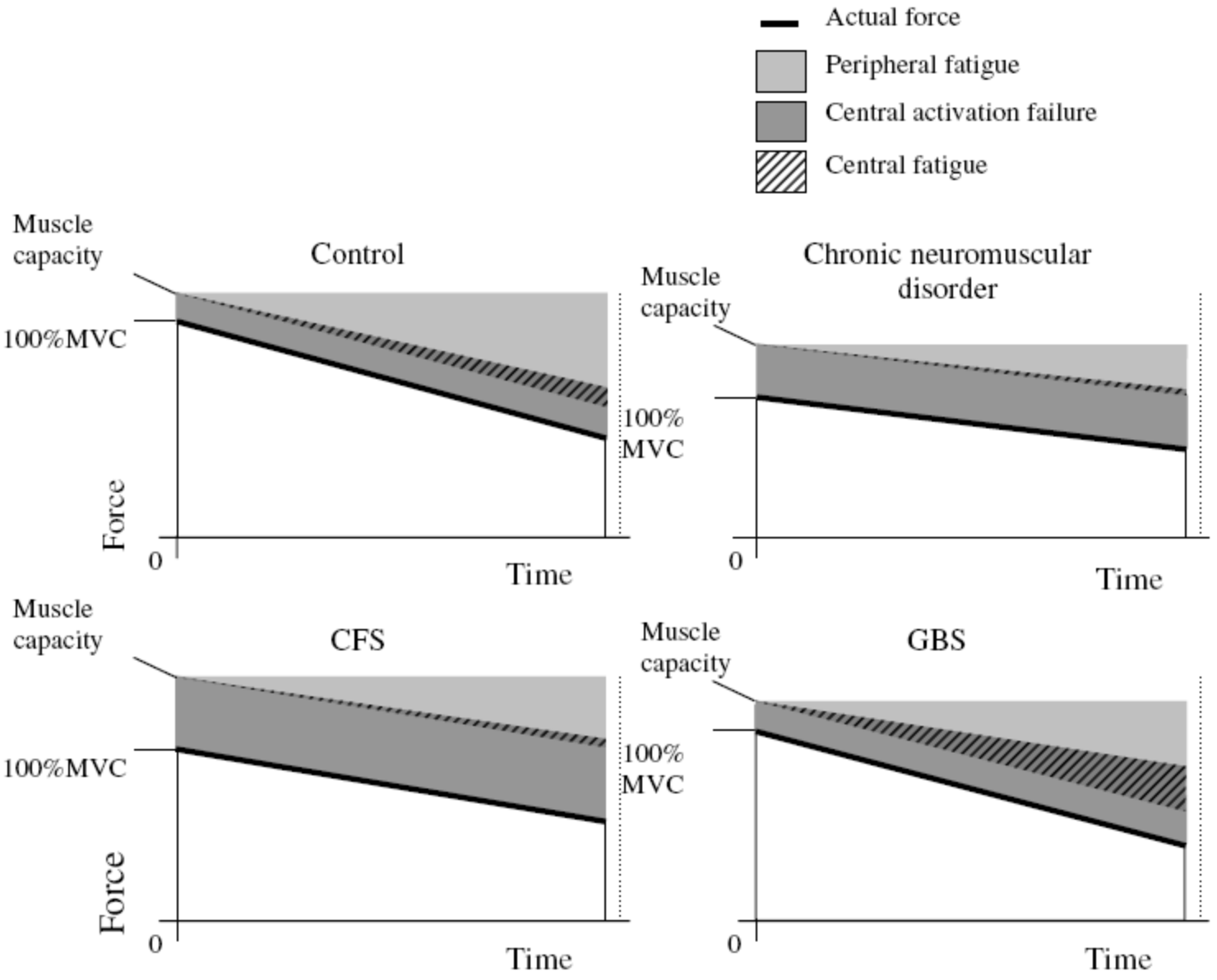
Experienced fatigue and central activation failure

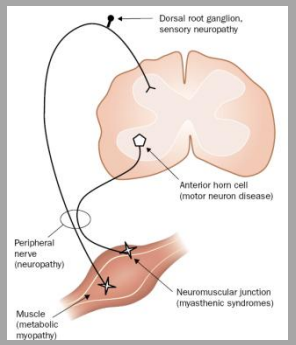









Actual force
Peripheral fatigue
Central activation failure
Central fatigue
Muscle capacity
Control
100%MVC
Force
0
Time
Muscle capacity
Chronic neuromuscular disorder
100% MVC
0
Time
Muscle capacity
CFS
100%MVC
Force
0
Time
Muscle capacity
GBS
100% MVC
0
Time



Review

Fatigue in neurological disorders

Abhijit Chaudhuri, Peter O Behan

Lancet 2004; **363:** 978–88

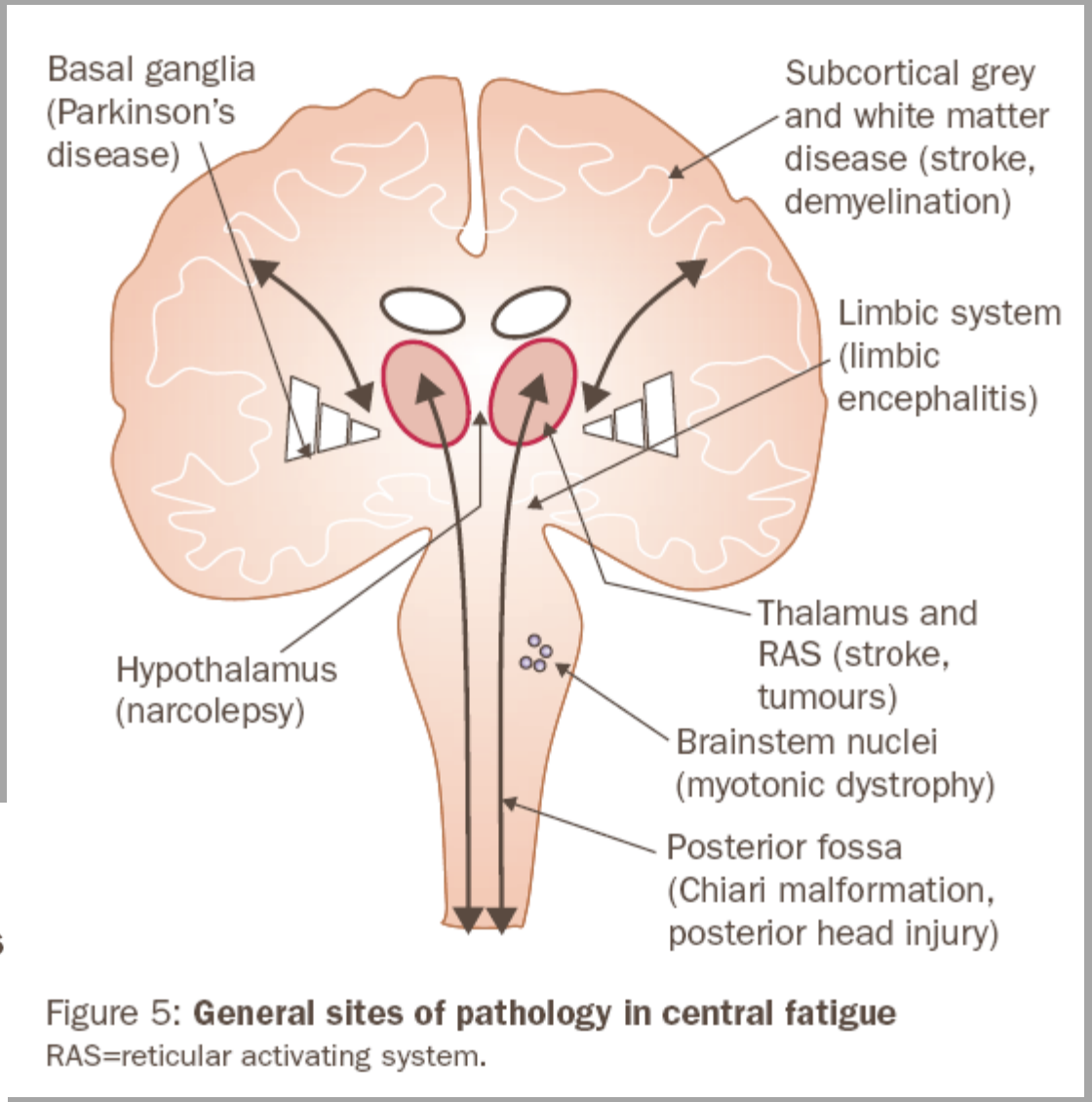


Figure 5: **General sites of pathology in central fatigue**
RAS=reticular activating system.

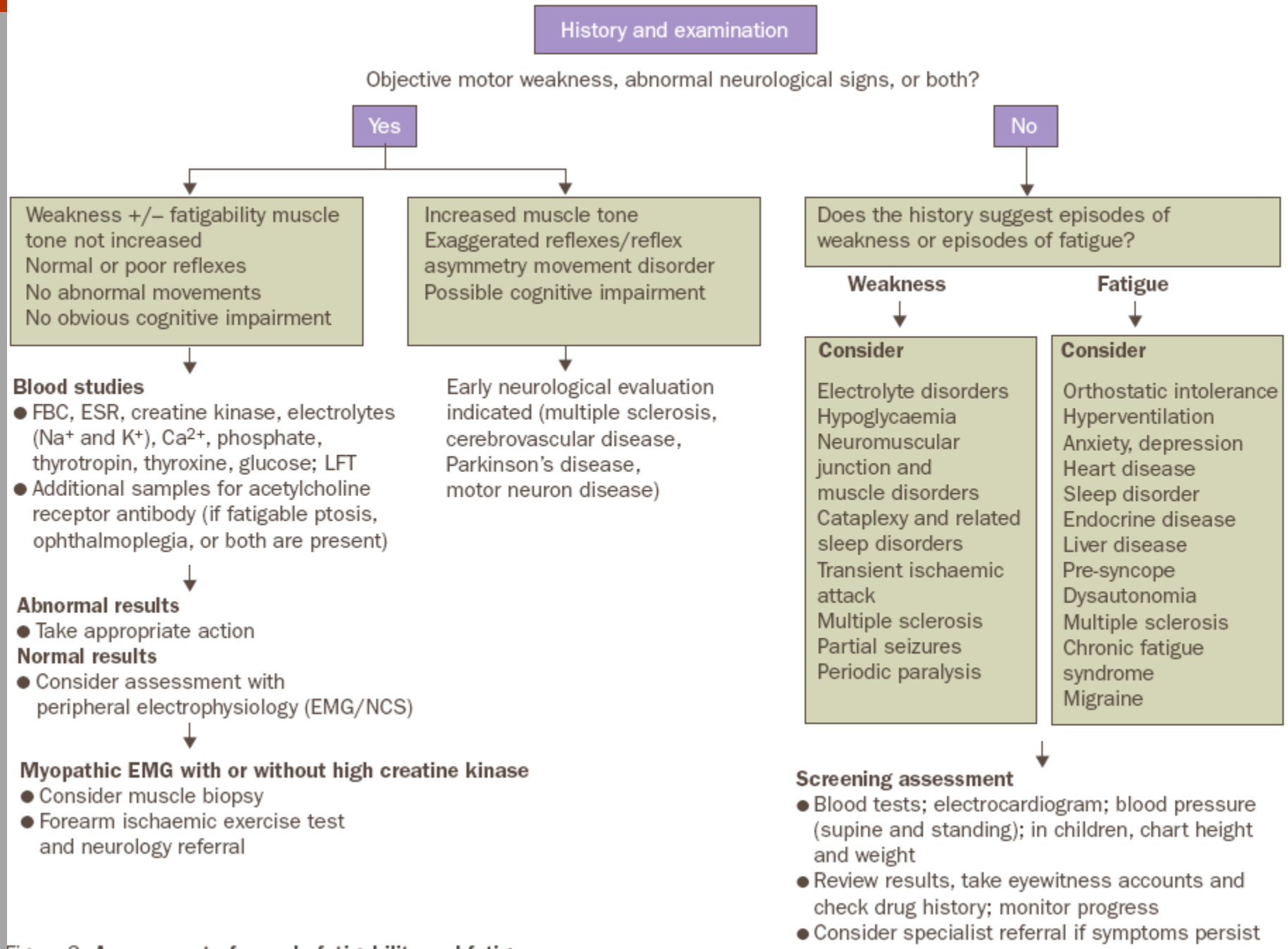


Figure 3: **Assessment of muscle fatigability and fatigue**

Table 3
Neurological disorders associated with central fatigue

Cerebral vasculitis and cerebrovascular diseases
Channelopathies
Developmental disorders (cerebral palsy, Chiari malformations)
Encephalitis lethargica
Hypothalamic and pituitary diseases
Intracranial infections (meningitis and encephalitis)
Metabolic encephalopathy and mitochondrial diseases
Migraine
Motor neuron disease
Multiple sclerosis
Multiple system atrophy
Narcolepsy and related sleep disorders
Paraneoplastic (limbic encephalitis, opsoclonus-myoclonus)
Parkinson's disease and other parkinsonian disorders
Posterior head injury
Post-infective fatigue states (poliomyelitis, Lyme disease, Q fever, and viral fatigue)
Post-operative (posterior fossa and cardiopulmonary bypass surgery)

(Adapted from Chaudhuri and Behan, 2004)

NeuroImage **13**, 1186–1192 (2001)
doi:10.1006/nimg.2001.0759, available online at http://www.idealibrary.com on IDEAL®

Fatigue in Multiple Sclerosis Is Associated with Abnormal Cortical Activation to Voluntary Movement—EEG Evidence

Letizia Leocani,* Bruno Colombo,† Giuseppe Magnani,† Filippo Martinelli-Boneschi,† Marco Cursi,* Paolo Rossi,† Vittorio Martinelli,† and Giancarlo Comi*,†

These findings are consistent with a central origin of fatigue in MS and indicate cortical dysfunction even during a simple motor task, resulting in hyperactivity during movement execution and failure of the inhibitory mechanisms intervening after movement termination.

In sum, fatigue seems to be a more or less universal symptom in central disorders.

In the disorders in which the symptom has been extensively studied it was found to correlate with specific brain dysfunctions and thus to have a specific pathophysiology in the different diseases,

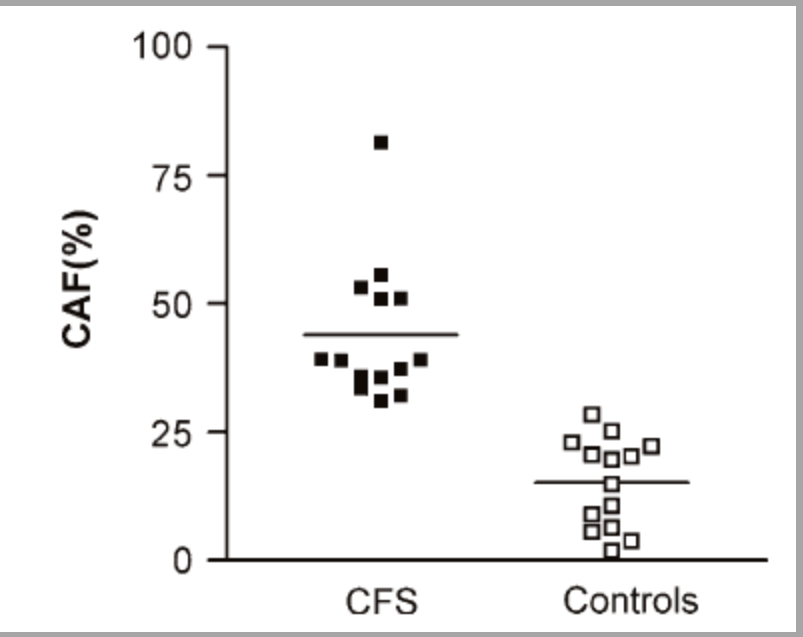
Examples of which are its relationship with impairments of the inhibitory circuits in the primary motor cortex in MS, its reversal by levodopa in PD

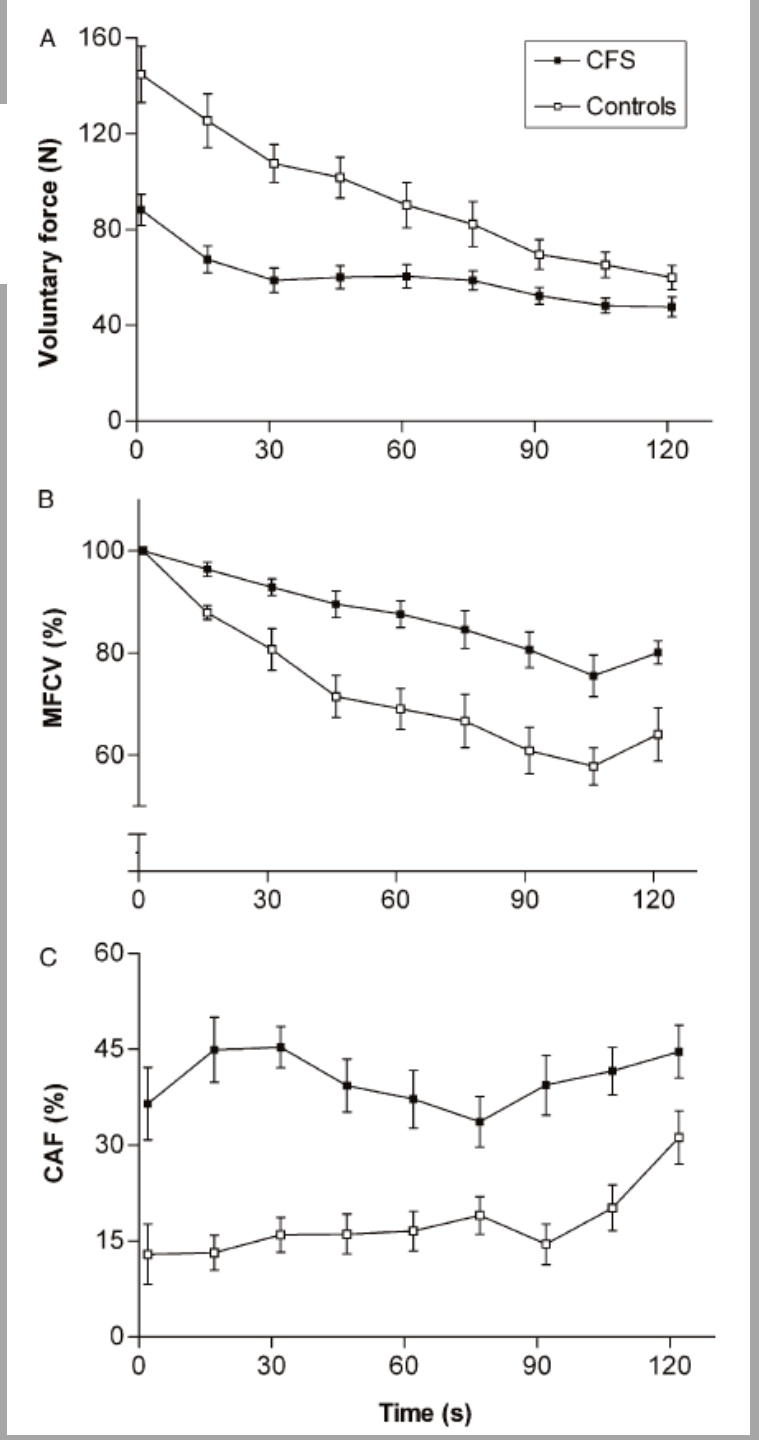
In conclusion, fatigue in neurological disorders is a complex problem that merits a multilevel approach to disentangle the diverse mechanisms involved in this devastating symptom.

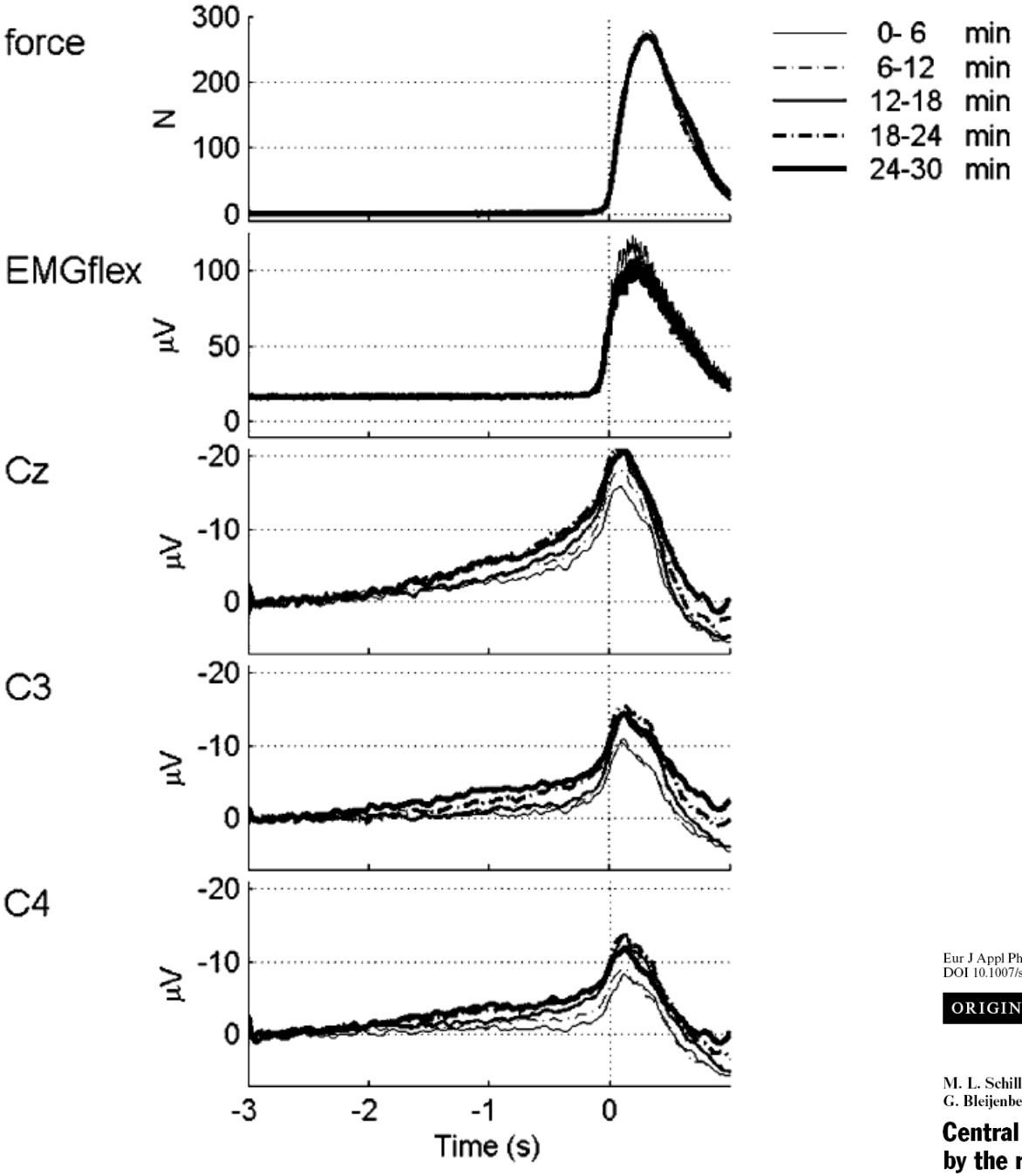
Diminished central activation during maximal voluntary contraction in chronic fatigue syndrome

M.L. Schillings[a], J.S. Kalkman[b,c], S.P. van der Werf[c], B.G.M. van Engelen[d], G. Bleijenberg[b], M.J. Zwarts[a,d,*]

Clinical Neurophysiology 115 (2004) 2518–2524







Eur J Appl Physiol (2006)
DOI 10.1007/s00421-006-0211-z

ORIGINAL ARTICLE

M. L. Schillings · J. S. Kalkman · S. P. van der Werf
G. Bleijenberg · B. G. M. van Engelen · M. J. Zwarts

Central adaptations during repetitive contractions assessed by the readiness potential