

Determinants of fatigue in MS

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The Multiple Sclerosis Council for Clinical Practical Practice Guidelines defines fatigue as:

a subjective lack of physical and/or mental energy that is perceived by the individual or caregiver to interfere with usual and desired activities



MS fatigue (FSS)

Motor parameters

- force
- twitch interpolation
- brain activation (fMRI)
- transcranial magnetic stimulation (TMS)



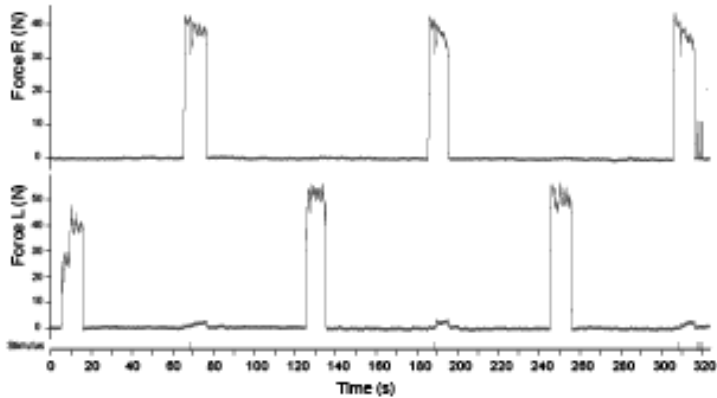
Subjects

- 20 R-R, 7 ♂, 20-58
- MS: 1-23 years, median: 4
- EDSS: 0-5, median: 2.5
- 21 matched controls

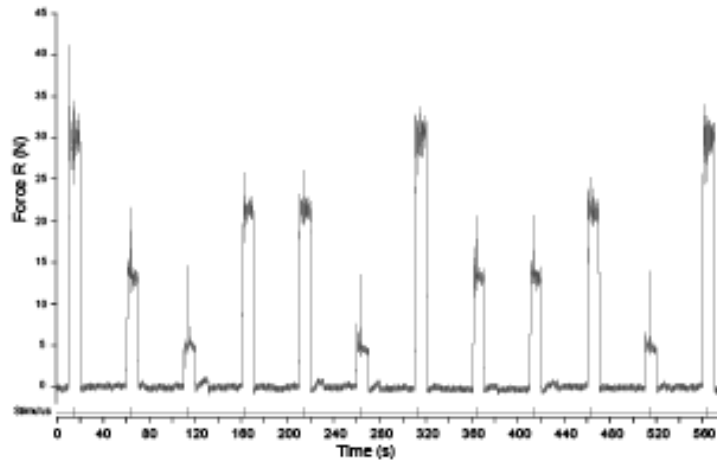


Raw data

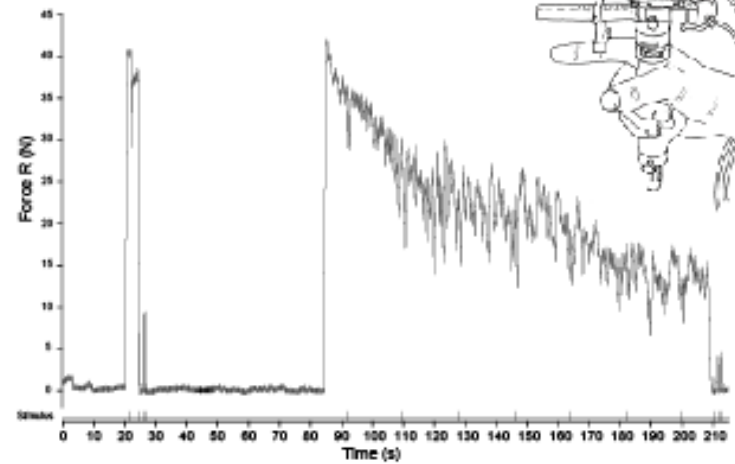
A. Maximal voluntary contractions



B. Submaximal contractions



E. Sustained contraction



F. Force transducer



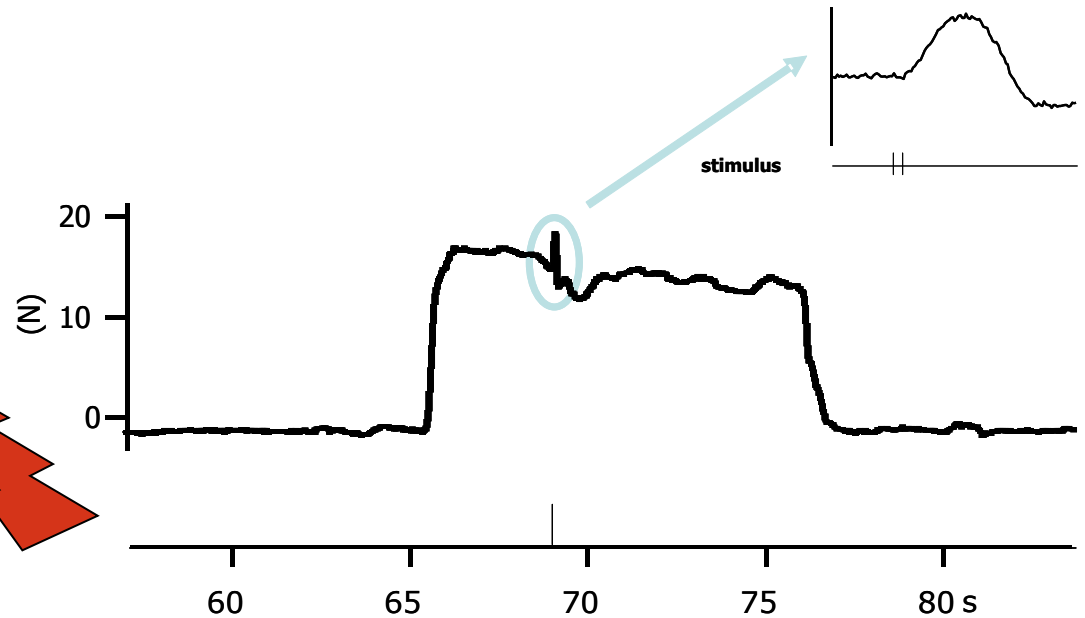
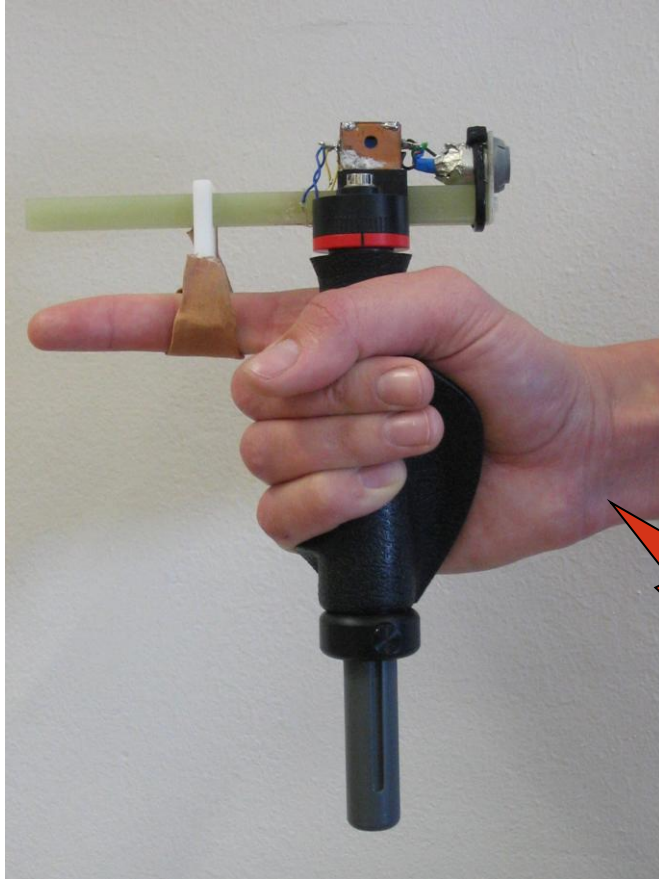
Analyse

Association between FSS-scores and :

- MVCs ♂ ♀
- Central activation
- TMS-data
- Motor fatigue
 - » central fatigue
 - » peripheral fatigue



Central activation-1



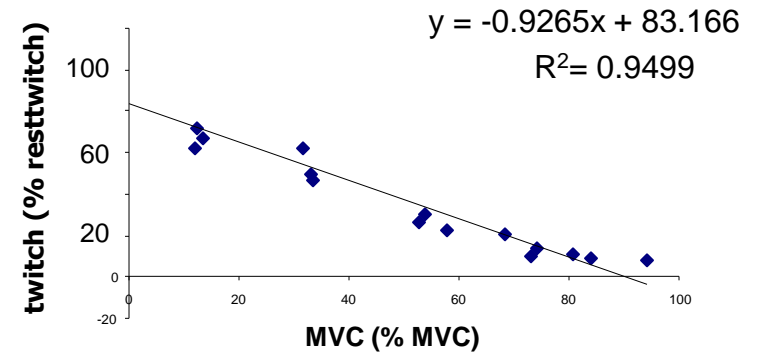
Ulnar nerve stimulation
(double pulse, 10 ms interval)



Estimated central activation-2

Estimate twitch @ 100% MVC

-> 100- eTwitch

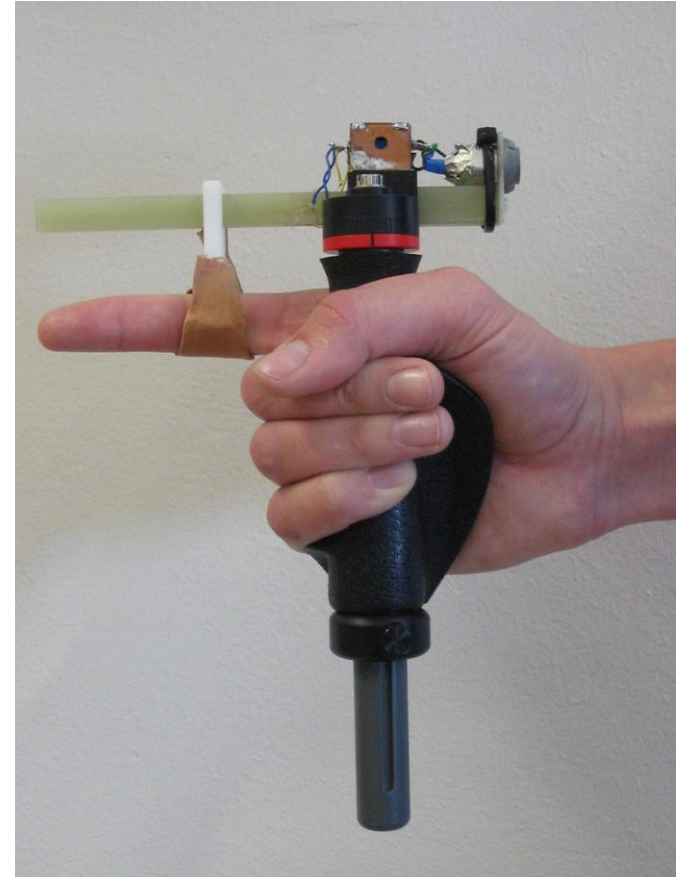


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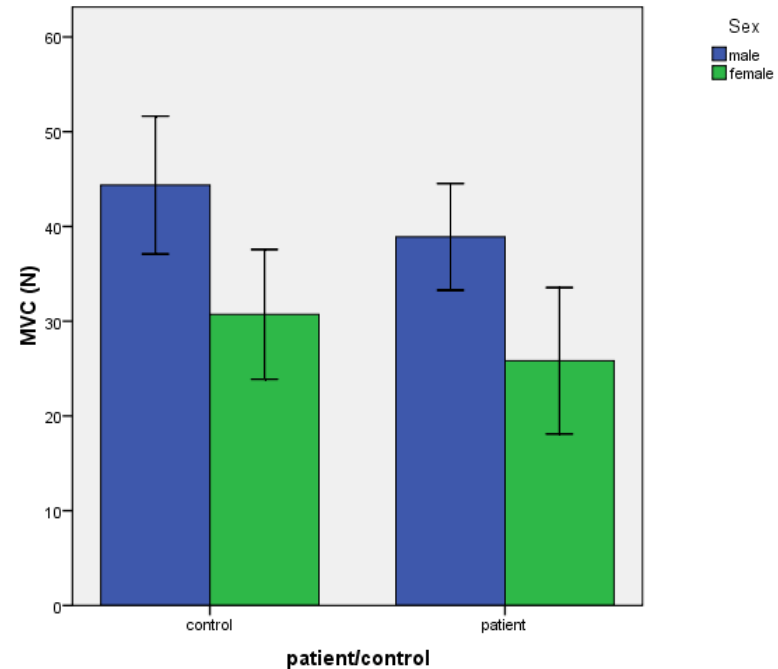
MVC Z-score

- MVC ♂
 - Patients
 - Controls – *reference*
- MVC ♀
 - Patients
 - Controls - *reference*



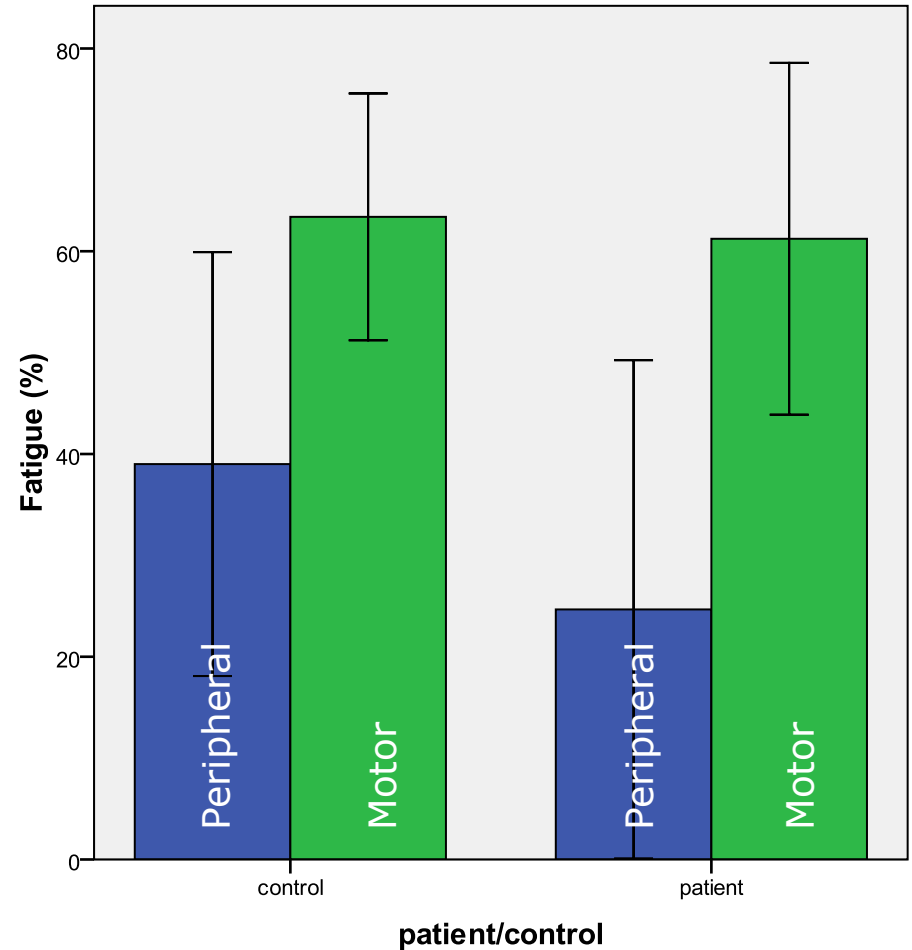
Results

- MVC
 - patients: ♀ 26 ± 8 ♂ $39 \pm 6N$
 - controls: ♀ 31 ± 7 ♂ $44 \pm 7N$
 - Z-scores: $p < 0.03$
- Voluntary activation
 - patients: 95 ± 5
 - controls: 93 ± 8
- Estimated voluntary activation
 - patients: 103 ± 17
 - controls: 113 ± 10 ($p = 0.03$)



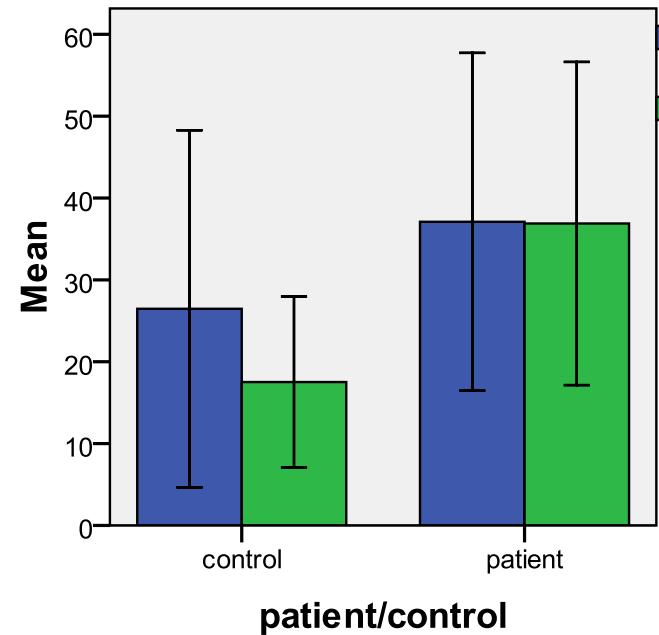
Results 2-min contraction

- **Motor fatigue**
 - patients: $61\% \pm 17$
 - controls: $63\% \pm 12$
- **Peripheral fatigue**
 - patients: $23\% \pm 25$
 - controls: $39\% \pm 21$
 - group ($p=0.04$)



Results 2-min contraction

- **Central fatigue (mean twitch)**
 - patients: $37\% \pm 20$
 - controls: $18\% \pm 10$ ($p=0.001$)
- **Central fatigue (motor fatigue-peripheral fatigue)**
 - patients: $37\% \pm 21$
 - controls: $24\% \pm 23$ ($p=0.08$)



Association with FSS in MS

- Motor fatigue
 - $R^2=0.10$, $p=0.18$
- MVC Z-score
 - $R^2=0.13$, $p=0.01$
- Voluntary activation (mean)
 - $R^2=0.25$, $p=0.03$
- Voluntary activation (calculated)
 - $R^2=0.29$, $p=0.02$



Association with FSS in MS

J Appl Physiol
91: 2686–2694, 2001.

Sex differences in the fatigability of arm muscles
depends on absolute force during isometric contractions

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- Motor fatigue en MVC Z-score
 - $R^2=0.45$, $p=0.01$



Association with FSS corrected for depression

- MVC Z-score
 - $R^2=0.64$, $p=0.001$
- Motor fatigue en MVC Z-score
 - $R^2=0.77$, $p=0.001$



Conclusion

MS patients

- weaker
- lower central activation

FSS in MS patients is associated with

- force measurements and central activation during sustained contraction
- Combination of HADS and force measurements



Conclusion



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