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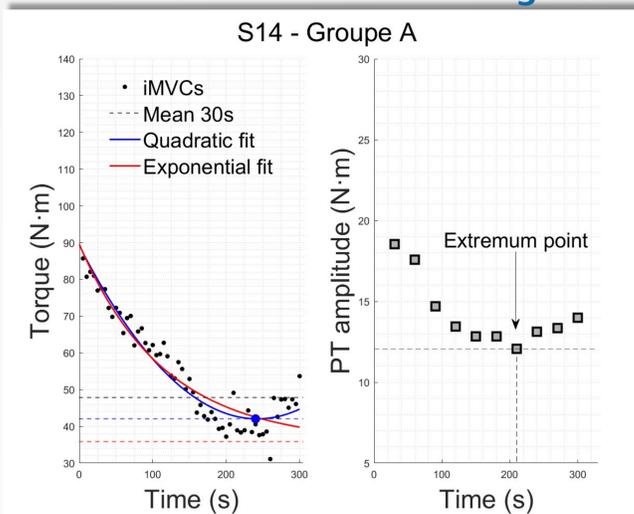
Investigating critical torque estimation in untrained participants

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Introduction

During an all-out test, **peak torques decrease exponentially and reach a plateau called Critical Torque (CT)**, due to an accumulation of fatigue [1]. Both central and peripheral fatigue can be quantified by changes in Voluntary Activation level (VA%) and the Potentiated Torque amplitudes (PTa) [2, 3]. It has been shown that **PTa decrease exponentially during an allout** [4] but, the plateau is not always clearly identifiable. **We observed that PTa could re-increase at the all-out end in some participants** (group A, fig.1) suggesting pacing strategies or neuromuscular recovery. While pacing strategies are difficult to prevent and biases CT estimation in untrained adults, it seems fundamental to **adjust CT estimation for these untrained participants**.

Figure 1

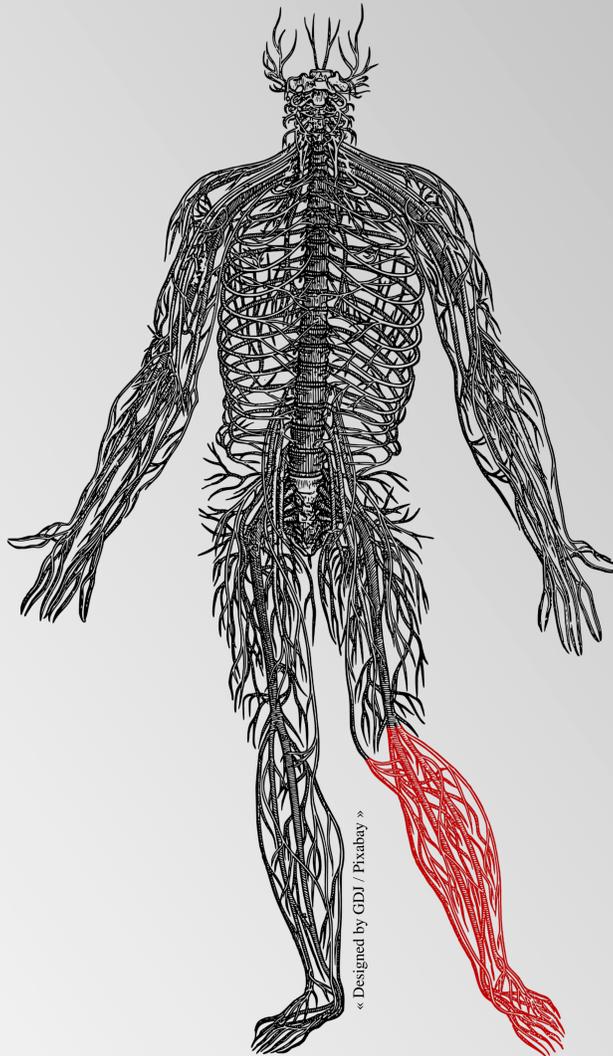


We aimed to test and compare different methods of estimating CT, to reduce estimation bias in untrained adults

Methods

- **34 untrained adults** performed an all-out test with the plantar flexors.
- **Participants with an extremum point** (fig.1) in PTa kinetic were allocated to **group A** (n=14; 31,21±9,69 yrs.) and the others to **group B** (37,70±14,20 yrs.).

- PTa and VA% were evaluated every 30s.
- Four critical torque (CT) estimation methods were compared:
 - the **average of the last 30s** (CT_{end-test})
 - the **asymptote of an exponential fit** (CT_{exp}) in iMVCs kinetic
 - the **minimum of a quadratic fit** (CT_{quad}) in iMVCs kinetic
 - a **method of extrapolation** (CT_{extrap}) between the variations in PTa and the variations in iMVC (fig.2).



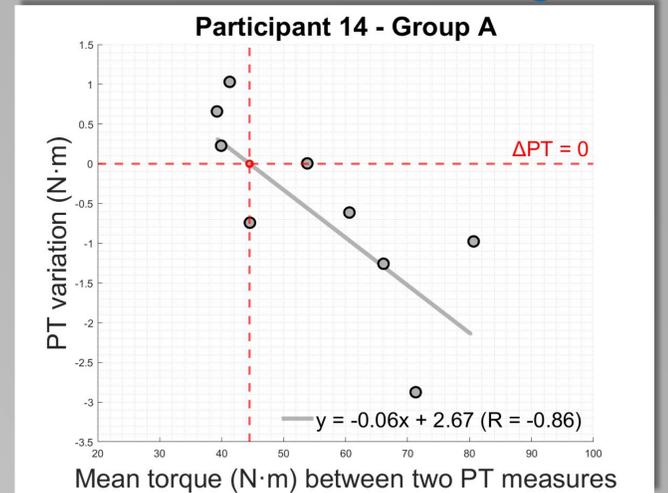
Discussion

- The presence of **recovery significantly influences CT estimation**, even though torque kinetics do not differ between groups.
- In untrained participants, **CT_{end-test} should be preferred and CT_{exp} should be avoided**.
- Extrapolation method should be further investigated.
- It seems necessary to adjust the all-out test so that it is less dependent on the participant's maximum voluntary contraction abilities.

References

- [1] M. Burnley, *Journal of applied physiology*, (2009)
- [2] P.A. Merton, *The Journal of Physiology*, (1954)
- [3] M. Burnley, A. Vanhatalo, A.M Jones, *Journal of applied physiology*, (2012)
- [4] Morel B, Lapole T, Liotard C, et Hautier C, *Frontiers in Physiology* (2019)

Figure 2



Results

Both group had similar iMVCs (p=0,39) and VA% (p=0,41) kinetics during allout, but **group A had lower PTa on averages during the test** (p=0,02). A group × method interaction (p<0,001) indicated that **CT_{extrap} was underestimated for group A** (-4,6% iMVC) and **overestimated for group B** (+4,8%) compared to **CT_{end-test}** (fig.3). Furthermore, **CT_{exp} was underestimated compared to the other methods** (p<0,002) for both groups (fig.3).

Figure 3

