



Investigating critical torque estimation in untrained participants

Antonin Le Corre, Nicolas A Turpin, Jérémie Begue, Antoine Mariani,
Nathan Caron, Georges Dalleau

► To cite this version:

Antonin Le Corre, Nicolas A Turpin, Jérémie Begue, Antoine Mariani, Nathan Caron, et al.. Investigating critical torque estimation in untrained participants. 20ième congrès de l'ACAPS REIMS 2023, Oct 2023, REIMS, France. hal-04558519

HAL Id: hal-04558519

<https://hal.science/hal-04558519>

Submitted on 26 Apr 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Public Domain

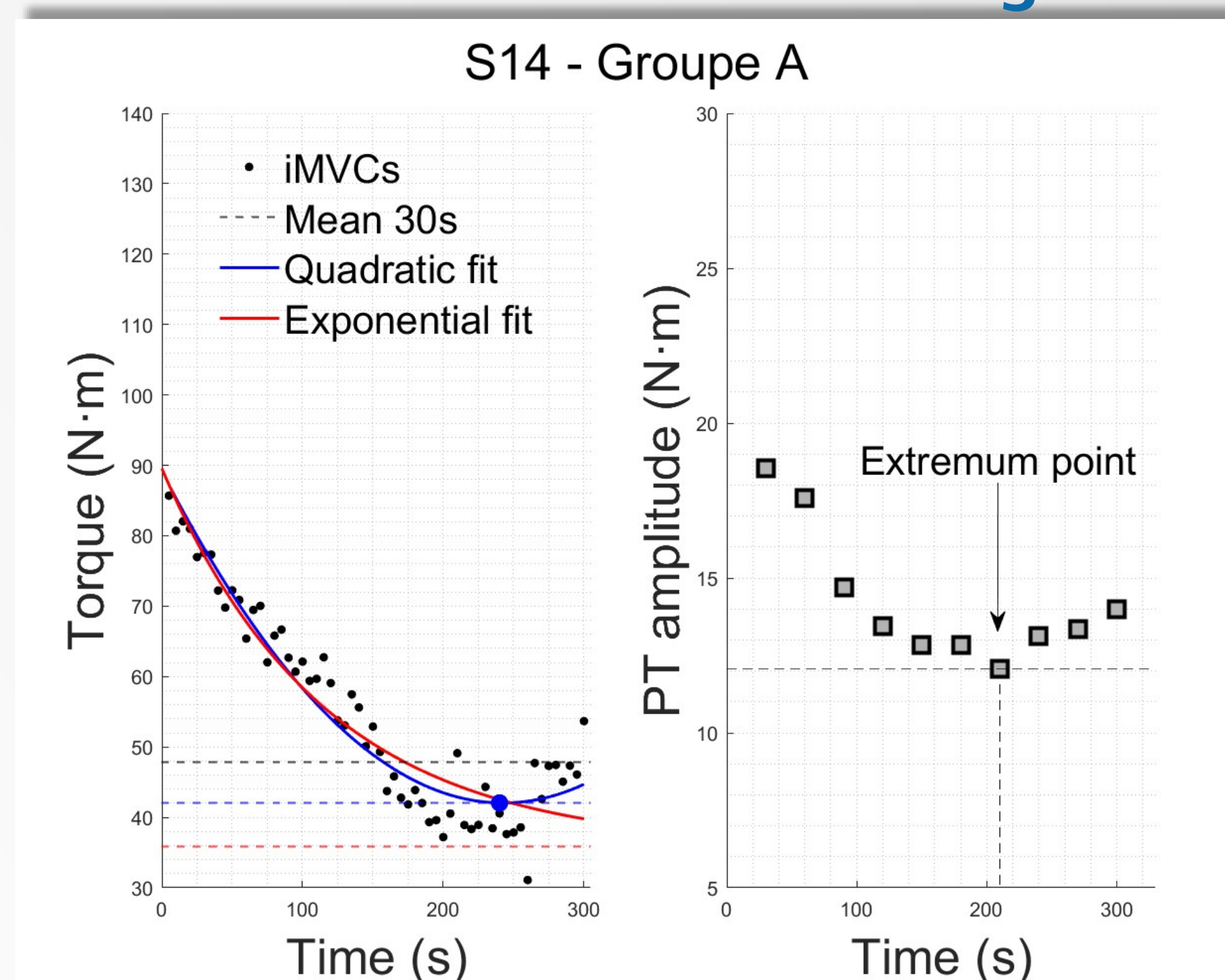
Investigating critical torque estimation in untrained participants

Antonin Le Corre ^a, Nicolas A. Turpin ^a, Jérémie Begue ^a, Antoine Mariani ^a, Nathan Caron ^a, Georges Dalleau ^a
^a Laboratoire IRISSE – EA 4075, UFR des Sciences de l'Homme et de l'Environnement, Université de La Réunion, 117 rue du Général Ailleret, 97430 Le Tampon, Île de La Réunion

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

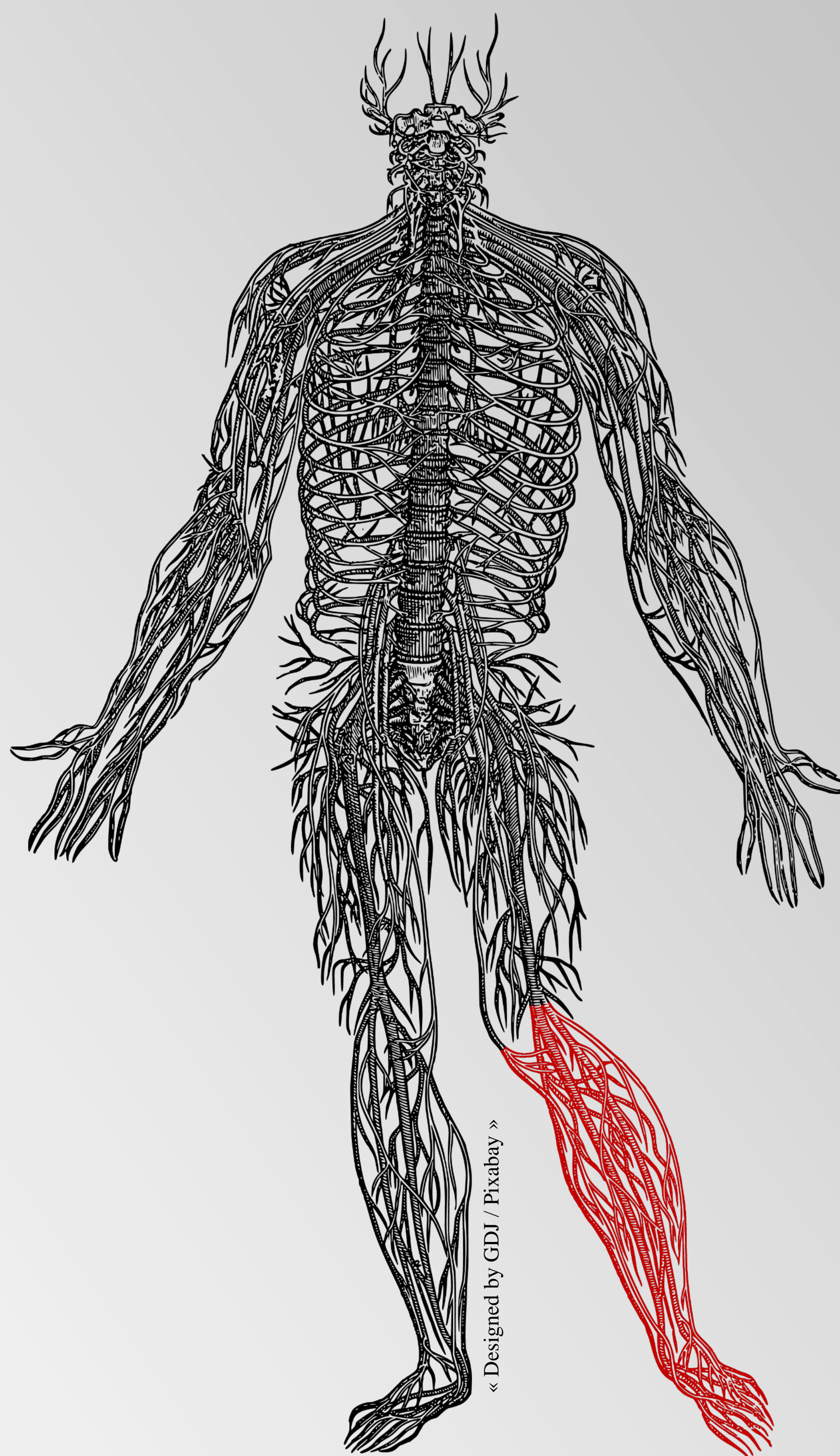


We aimed to test and compare different methods of estimating CT, to reduce estimation bias in untrained adults

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).



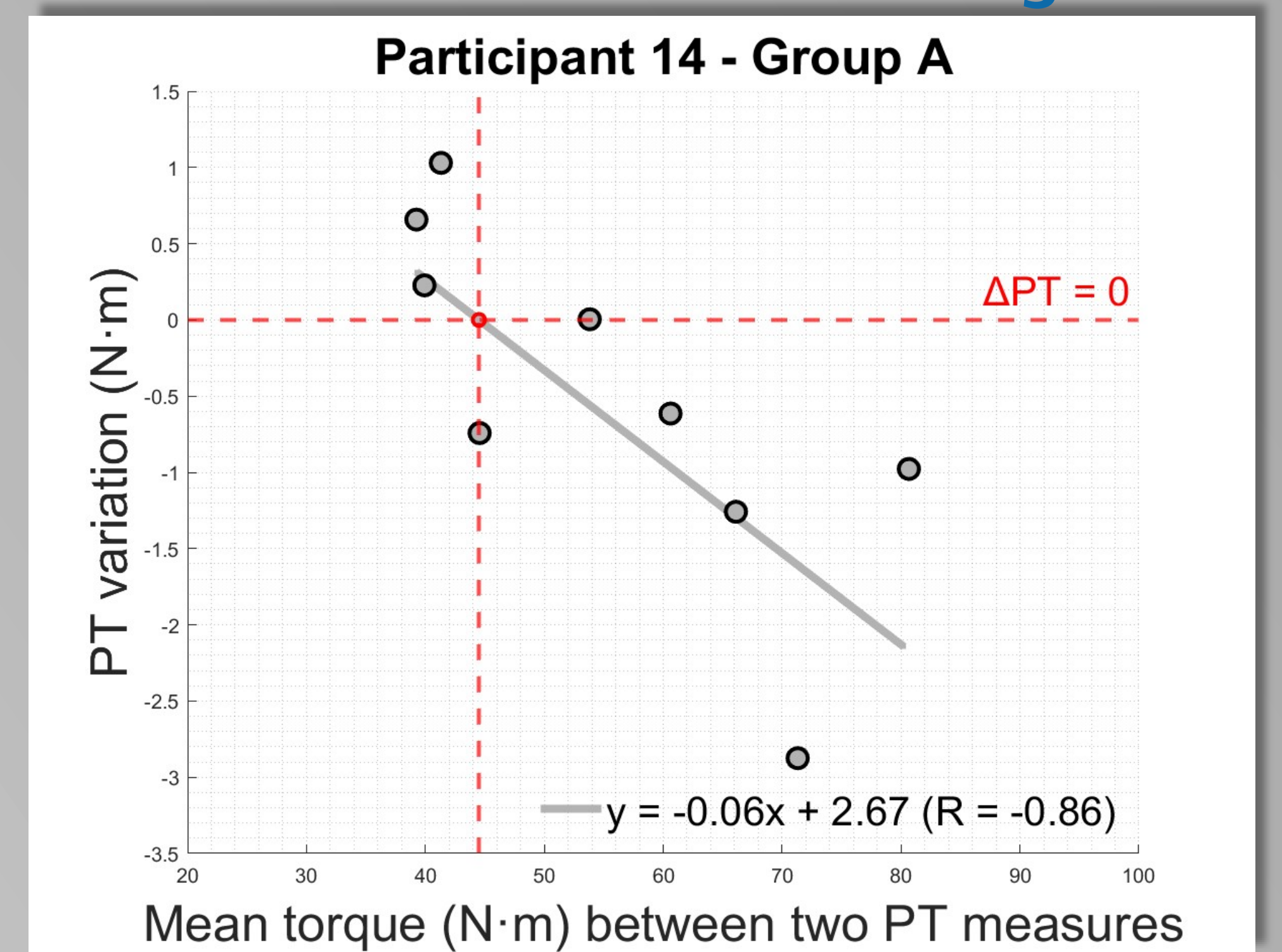
Discussion

- 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

