

Abstract

Influence of the dynamometer and knee joint axis of rotation alignment on the isokinetic measurements

J.L. Croisier, P. Ciavatta and B. Forthomme

Department of Physical Medicine and Rehabilitation, University of Liege, Belgium

E-mail: jlcroisier@ulg.ac.be

Objectives: Factors that could influence accuracy of isokinetic assessment deserve careful attention [1,2]. In order to develop accurate and standardized test protocols, many investigations have focused for instance on gravity correction, visual feedback, range of motion, resistance pad position. The aim of our study was to determine the consequences of an inappropriate alignment between the dynamometer and knee joint axis of rotation on isokinetic measurements.

Methods: Twelve healthy male subjects (24 ± 2 years old) participated in one session of testing (Cybex Norm dynamometer) on their dominant leg. Four conditions of proper or intentionally altered (in the horizontal plane) alignment were randomly proposed. Based on proper alignment with the knee flexed at 90° , the altered alignments were designed as follows: joint axis of rotation placed 6 cm (–6) and 12 cm (–12) behind or 6 cm (+6) in front of the dynamometer axis of rotation in the horizontal plane (Fig. 1). Knee flexors and extensors performed 3 maximal repetitions for testing at $60^\circ/s$ in the concentric mode throughout a constant 100° range of motion. Subjects benefited from 3 preliminary submaximal trials for familiarization before the successive testing positions. Descriptive statistics and ANOVA tests were used to analyze the data.

Results: For both knee flexors (FI) and quadriceps (Q), measurements in the properly aligned and +6 positions showed no significant difference in peak torque (PT) (Fig. 2). By contrast, the PT corresponding to the joint

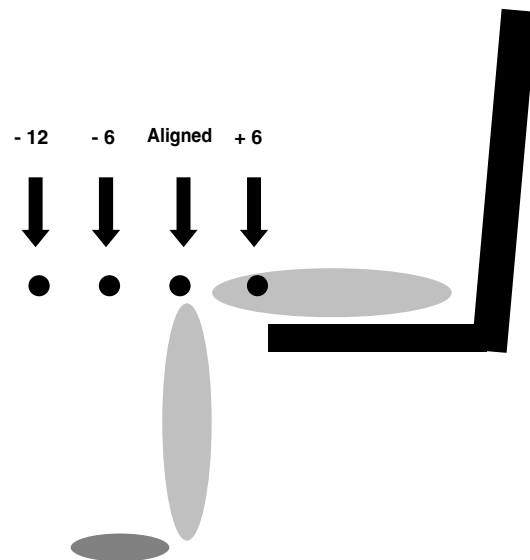


Fig. 1. Representation of proper and altered alignments between the knee joint and dynamometer axis of rotation.

axis of rotation placed behind the device axis of rotation (–6 and –12) were significantly ($p < 0.05$) decreased for both muscle groups, most notably on the quadriceps in the –12 position (–14% for that position compared to the properly aligned).

The same observations characterized the work parameter, even though the FI/Q ratio calculated from PT was not significantly influenced by the alignment

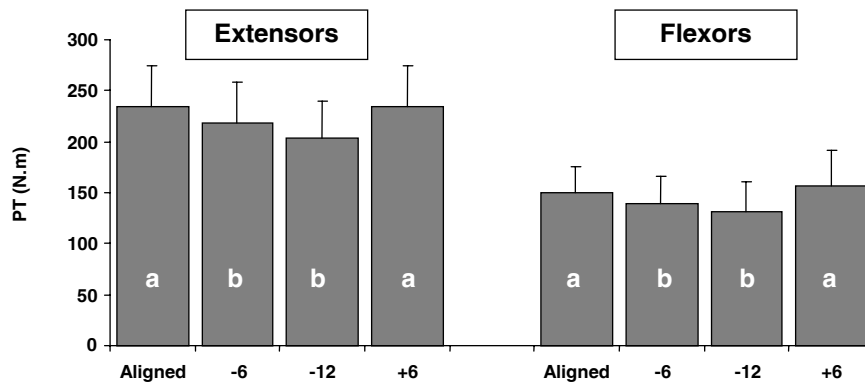


Fig. 2. Concentric peak torques (PT in N.m) developed by knee extensors and flexors at 60°/s: comparative study between proper or altered alignments. Different letters represent statistically significant differences ($p < 0.05$).

modalities.

Conclusion: We highlighted the influence of an improper alignment between the knee joint and dynamometer axis of rotation, particularly when the joint is positioned behind the dynamometer motor in the horizontal plane. A lack of precision on that point would introduce a factor confounding accurate isokinetic assessment.

References

- [1] Z. Dvir, *Isokinetics. Muscle testing, interpretation and clinical applications*, (second edition), Churchill Livingstone, 2004.
- [2] D.H. Perrin, *Isokinetic exercise and assessment*, Human Kinetics Publisher, 1993.