# EFFECTS OF ISOMETRIC AND ISOKINETIC CONTRACTIONS ON THE PATELLAR TENDON MOMENT ARM

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## INTRODUCTION

The purpose of this study was to examine the effects of contraction on knee joint mechanics and more specifically the effects of isometric and isokinetic contractions on the patellar tendon moment arm.

## METHODS

Three males (age 27±6.93 years, mass 77±4.36 kg, height 1.76±0.05 m) without any musculoskeletal injuries of the lower limbs volunteered to participate after signing informed consent and radiation risk information forms. The study was approved by the local Ethics Committee. The movements were performed on a CYBEX Norm fitted with an extended input arm, to allow an adequate gap (45 cm) between the chair and the main unit to accommodate the image intensifier of a GE FlexiView 8800 C-arm X-Ray system (Figure 1). The participants were positioned on the chair and were stabilised with the standard belts and thigh straps. The most prominent point of the femoral epicondyle on the lateral surface of the knee joint and a metal disc on a strip of Perspex glass that was rigidly attached to the chair were aligned with the dynamometer axis of rotation using a special laser pointing device.

**Figure 1**: Photograph of the experimental set-up.

The participants performed a passive and an isokinetic knee extension at 30 deg/s and an isometric knee extension at 20 deg of knee flexion. Moment and angular displacement data from the CYBEX were captured at 200 Hz and the movements were also recorded using a pulsed mode X-ray video at 25 frames/s. The patellar tendon (PT) moment arm was measured from the X-ray video based on the methods described before [1]. Distortion correction of the images was based on a thin-plate splines method [2].

## RESULTS AND DISCUSSION

There was an almost linear increase in the PT moment arm with intensity up to 75% MVC (Figure 2). The difference between moment arm values at rest and a given isometric contraction intensity was up to almost three times greater than

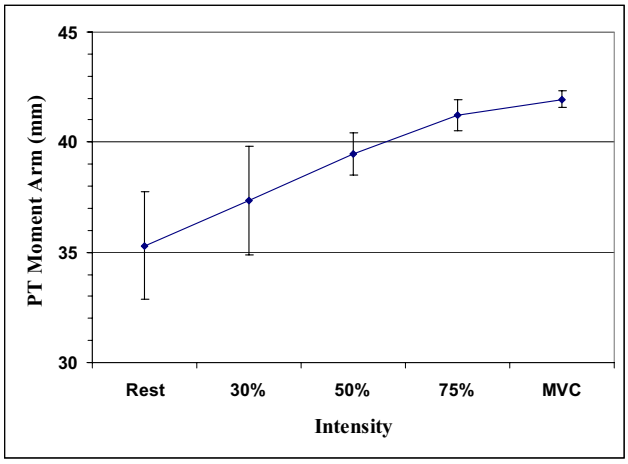


**Figure 2**: Patellar tendon moment arm (mean±sd) at rest and at different intensities of isometric contraction.

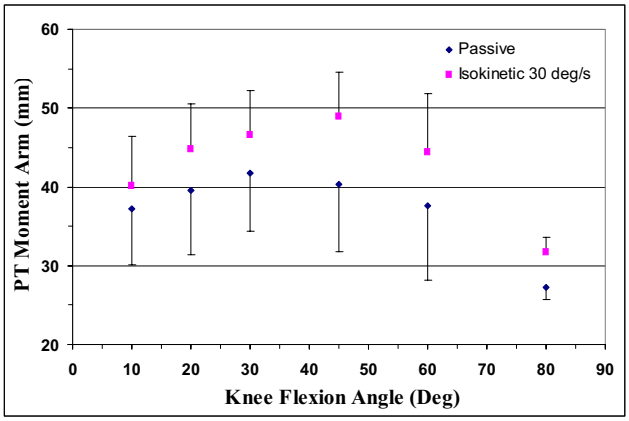


**Figure 3**: Patellar tendon moment arm (mean±sd) in different knee flexion angles in passive conditions (relaxed) and during isokinetic 30 deg/s knee extension.

that shown in Figure 2 when accounting for changes in tibio-femoral joint angle induced by contraction. There was also an increase in the PT moment arm between the passive movement and the isokinetic knee extension (Figure 3). The maximum average difference was recorded at 45 deg of knee flexion (8.7 mm). These results show that there are significant changes in the knee joint dynamics with contraction. Estimation of PT and knee joint reaction forces, for example, from the joint moment using PT moment arm data at passive conditions from the literature will significantly overestimate muscle and knee joint forces.

## REFERENCES

1. Baltzopoulos V. *Clin Biomech.* **10**, 85-92, 1995.
2. Fantozzi S. et al. *Med. Phys.* **308**, 124-131, 2003.