VARIABILITY IN UPPER AND LOWER EXTREMITY JOINT POSITION SENSE

+*Carroll, M.J; *Fick, G.H; *Zernicke, R.F
+*University of Calgary, Calgary, AB

Introduction

Joint position sense is the static component of proprioception, which has traditionally been quantified using some variation of a joint-angle matching paradigm. One such paradigm involves the active reproduction of a target angle following active positioning (ARAP). This technique is advantageous in that the subject is free of cutaneous input, which may confound the results. In preparation for future studies with individuals with benign joint hypermobility syndrome, here, we examined the associated variability of ARAP at the knee and elbow joints in normal individuals.

Methods

Five healthy, male volunteers (24-30 yr) participated in the study. All were physically active and had no history of a traumatic injury to either the elbow or knee. Reflective markers (15 mm) were placed on segments proximal and distal to the joints of interest and the 3D coordinates recorded (240 Hz) using 8 high resolution infrared cameras. Angular measurements were determined using an established joint coordinate system\(^1,2\). Subjects were instructed to flex slowly at the joint and signaled to stop when a random target angle between 45\(^\circ\) and 90\(^\circ\) was attained. The position was held for 5 s and, after 10 s of relaxation, they reproduced the angle as accurately as possible\(^3\). Angular measurements were recorded for 2 s and averaged. That was repeated for 10 trials at each joint. The dependent variable was absolute error (AE), expressed in degrees, and calculated as absolute value of the difference between reproduced and target angles.

Subjects provided informed, written consent. The study was approved by the University of Calgary ethics committee.

Results

Median AE at the knee and elbow were not significantly different between subjects. However, there was a trend (4/5 subjects) for greater variability in AE values at the knee compared to the elbow (Fig. 1). The variability at the knee was approximately 3 times that of the elbow.

Discussion

These preliminary data suggested that lower extremity joints were prone to larger error than the upper extremities. The results complemented other work suggesting force control was superior in the upper limb compared to the lower\(^4\). That phenomenon may be reflected in the more extensive use of fine motor actions of the upper limb in everyday tasks.

Preliminary results suggested a greater variability of AE at the knee compared to the elbow.

References


Fig. 1. Absolute angular error at the elbow and knee joints.

Acknowledgements

This research was funded in part by Canadian Institutes of Health Research.