INTRODUCTION

Patellofemoral pain syndrome (PFPS) is one of the most common knee disorders, with pain located primarily in the lateral aspect of the patellofemoral joint. Force imbalance in the knee extensor muscles has been associated with changes in patellofemoral tracking and is suspected to cause PFPS [1]. Specifically, weakness of the vastus medialis (VM) relative to the vastus lateralis (VL) is the usual imbalance associated with PFPS. This imbalance is believed to lead to the lateral shift in patellar tracking seen in PFPS patients compared to healthy subjects.

In a previous study, we found a slight lateral shift of patellar tracking following VM transection in New Zealand White rabbits (NZWR) for concentric and eccentric contractions [2]. However, and to our great surprise, patellar tracking occurred much more laterally for the passive compared to the active contractions. Since VM ablation caused a loss in average knee extensor force of 19%, we speculated that the shift in patellar tracking following may not have been caused by the lack of medial pull from VM, but rather, was caused by the decrease in overall knee extensor force.

Therefore, the purpose of this study was to evaluate the effect of knee extensor forces on patellar tracking. We hypothesised that patellar tracking will occur more medially with increasing knee extensor force.

METHODS

All experiments were performed on knees (n=4) of skeletally mature NZWR. Patellar tracking was recorded with a high speed camera at 200Hz and a spatial resolution of 80µm. A four point marker was rigidly attached to the patella via a bone screw and two further markers on the femur via bone pins, to record movements of the patella relative to the femur. Rabbits were fixed in a stereotaxic frame, while the tibia was attached to a lever arm connected to a motor allowing for knee extension/flexion between 30° and 90°at 40°/s. Patellar tracking was recorded for passive and active concentric and eccentric knee extensor contractions, before and after VM transection and for five different force levels.

Patellar tracking was evaluated every 5° of knee extension between 30° and 90°, for all force levels, and before and after VM transection.

RESULTS

As knee extensor force increased, the patella tracked more medial for eccentric and concentric contractions (Figure 1). For equal knee extensor forces, patellar tracking was the same before and after VM transection.

Figure 1: Comparing tracking path for concentric contraction as force increases from passive to 100% muscle force.

DISCUSSION AND CONCLUSIONS

We conclude from the results of our study that patellar tracking is not affected significantly by knee extensor imbalance (VM cut), but depends strongly on the total knee extensor forces, with the patella tracking more medially with increasing force. In agreement with these results, differences in active and passive patellar tracking have been observed in the human knee [3]. Therefore, when comparing patellar tracking before and after an intervention, knee extensor forces must be matched, otherwise erroneous conclusions might be drawn.

REFERENCES


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