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SAGITTAL HIP – KNEE COORDINATION DURING A 45 DEGREE CUTTING TASK

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Introduction

- Hashemi et al.(1) hypothesised that concurrent hip extension and knee flexion is one of four conditions that combine to result in non-contact ACL injury (Fig. 1)
- Fatigue may have an adverse effect on this injury mechanism(1)
- The hip extension and knee flexion coordination pattern has not previously been investigated in an ACL injury context

Aim

To understand hip-knee coordination and the effect of fatiguing exercise during a 45° cut

Methods

- Participants
  - 9 female team sports players, national / international level
- Protocol:
  - Dominant leg tested
  - Pre-post tests: 12 repetitions of a 45° cut
  - 6 cycles of a sport-specific fatiguing protocol. Each cycle contained:
    - 5 drop jumps
    - Multidirectional short sprints
- Analysis:
  - Vector coding coupling angle calculated (Fig. 3) for the impact phase (first 40 ms) of each contact and binned into coordination patterns (Fig. 4)
  - Average time spent in each coordination pattern calculated for each participant

Results & Discussion

- The fatiguing exercise elicited a similar HR and RPE response (Fig. 2) to netball match play(2)
- Hip extension–knee extension was observed followed by hip extension–knee flexion during the impact phase of the cut
- Concurrent hip extension and knee flexion was dominant pre and post fatigue (Fig. 5). This coordination pattern has been hypothesised as one that generates higher ACL strains(2)
- No meaningful changes were observed in the time spent in a coordination pattern as a result of fatigue (Fig. 5)

Practical Outcomes

- We may want to advocate a less stiff approach where flexion occurs both at the hip and knee at initial contact to reduce injury risk, but the effect this may have on performance is not currently known.
- The effect of fatigue may not need to be a training focus for the group but individuals that changed their coordination as a result of fatigue may benefit from working on their fatigability in training.

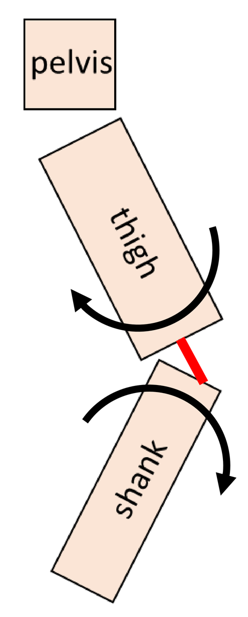

Figure 1. Hip ext – knee flex injury mechanism.

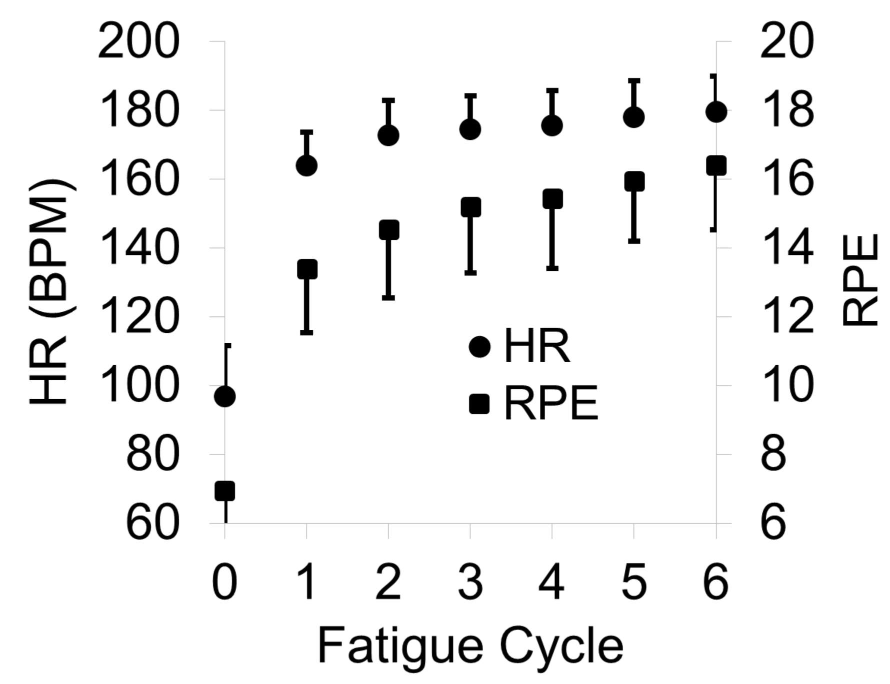

Figure 2. Effect of sport-specific fatigue on heart rate (HR) and rating of perceived exertion (RPE).

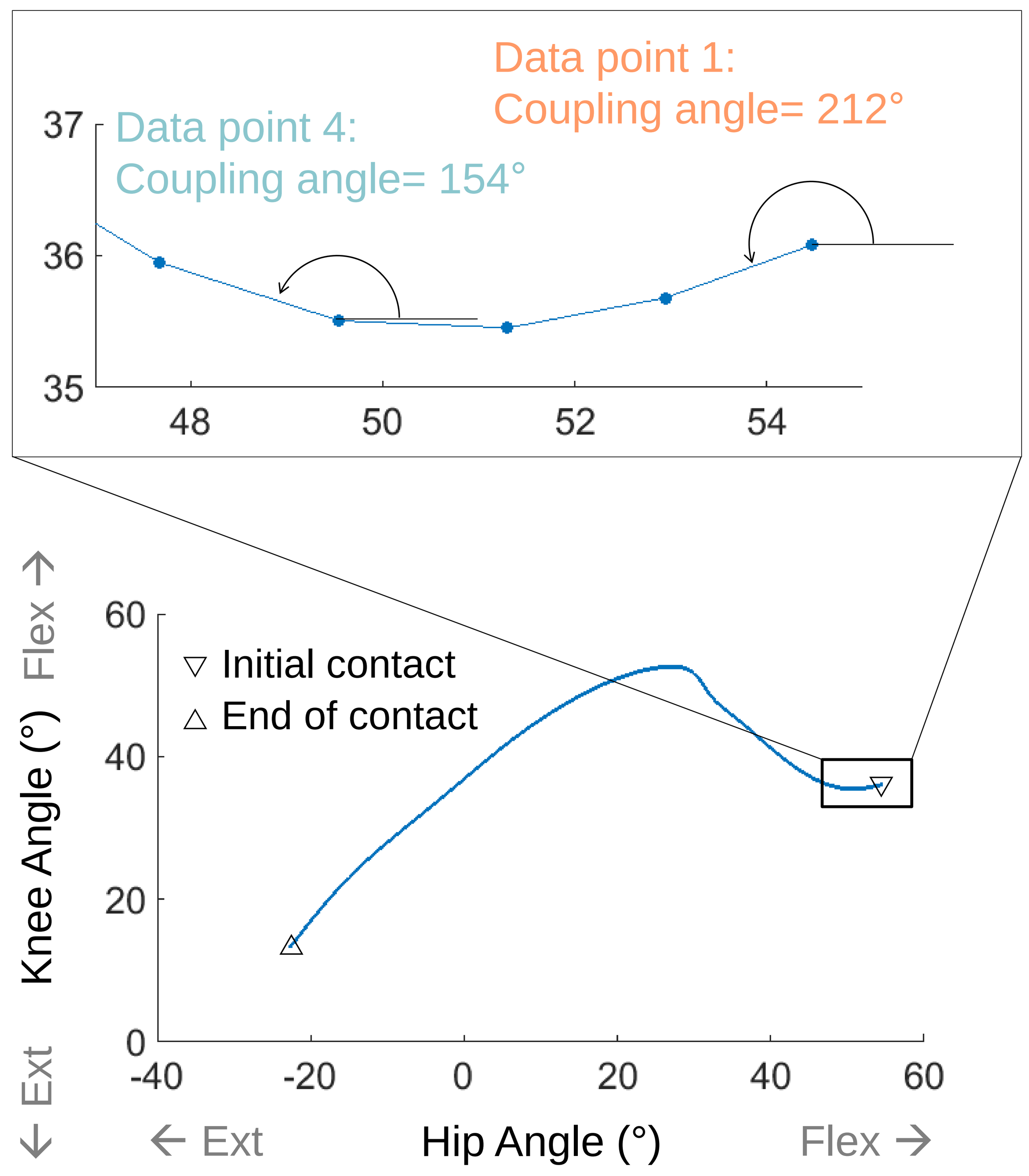

Figure 3. Vector coding coupling angle calculation.

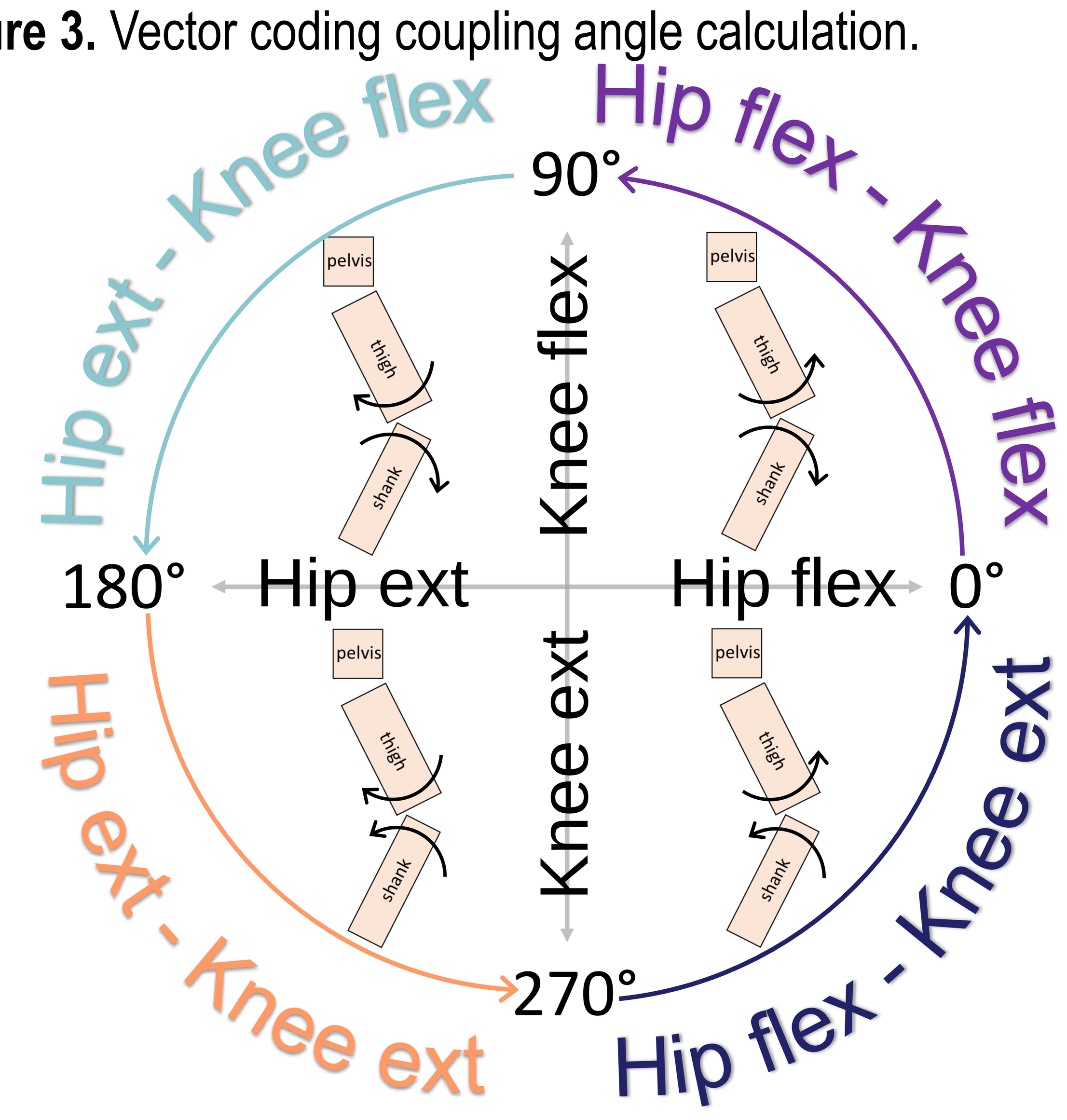

Figure 4. Binning of coupling angles into coordination patterns.

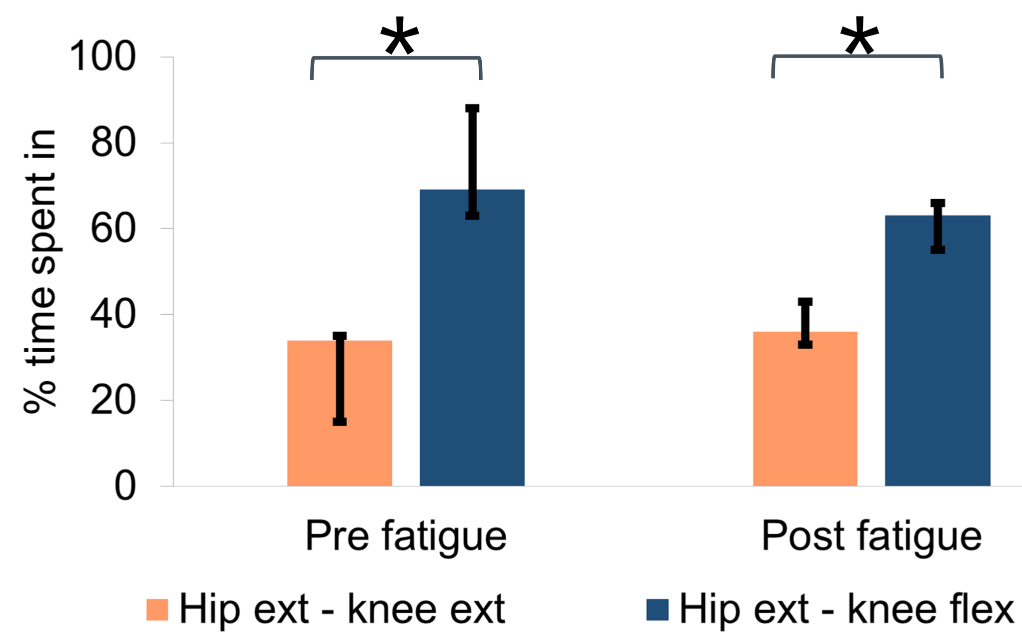

Figure 5. Percentage time spent in each coordination pattern.

References

(1) Hashemi, J., et al. (2011). Hip extension, knee flexion paradox: a new mechanism for non-contact ACL injury. *J Biomech*, ***44***, 577-85.

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