Inter-individual Variation in Coordination and Control of Countermovement Jumps

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Summary

A modified vector coding technique was used to quantify coordination and control during countermovement jumps by 16 males. Previously reported group-level coordination patterns were confirmed, although substantial inter-individual variation existed. Patterns of thigh-shank coordination and control were observed corresponding to a 'deep' or 'shallow' countermovement strategy, each used successfully within the cohort.

Introduction

Coordination patterns during countermovement jumps (CMJ) have previously been described at the group level [1]. Thigh–shank segment coupling showed a general anti-phase and thigh dominated coordination pattern during both the eccentric and concentric phases, except at the transition where an in-phase and shank dominated coordination pattern was observed. However, inter-individual variation in these coordination and control strategies is yet to be explored.

Methods

Sixteen males each performed three maximal CMJs, with segmental kinematics recoded via 3D motion capture. For each participant's highest jump, a modified vector coding technique [2] was used to quantify inter-segmental coordination (Figure 1). Readers are directed elsewhere for further information on vector coding, coordination pattern classification, and associated data visualisations [2].

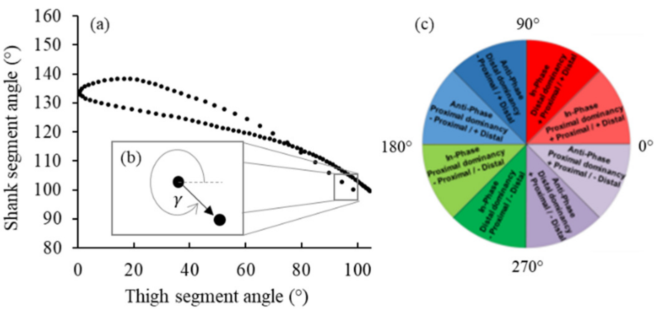

Figure 1: (a) angle–angle plot representing thigh and shank segment angles during a CMJ; (b) expanded view of one coupling angle that is assigned to a coordination pattern classification (c) [2].

Results and Discussion

At the group level, previous results [1] were confirmed (Figure 2a): an anti-phase and thigh dominated thigh-shank coordination pattern during both the eccentric and concentric phases, except at the transition where an in-phase coordination pattern was again observed. Inter-individual variation was greatest at movement initiation and transition between concentric and eccentric phases. Coupling angle mapping and profiling techniques highlighted patterns of thigh-shank coordination and control corresponding to a 'deep' (greater inter-data point range of motion, early anti-phase coordination) or 'shallow' (lesser range of motion, early in-phase coordination) countermovement strategy (Figure 2b). Both strategies were used successfully within the cohort (*e.g.,* by P1 and P2, respectively). Analysis of alternative segment couples will also be presented and discussed.

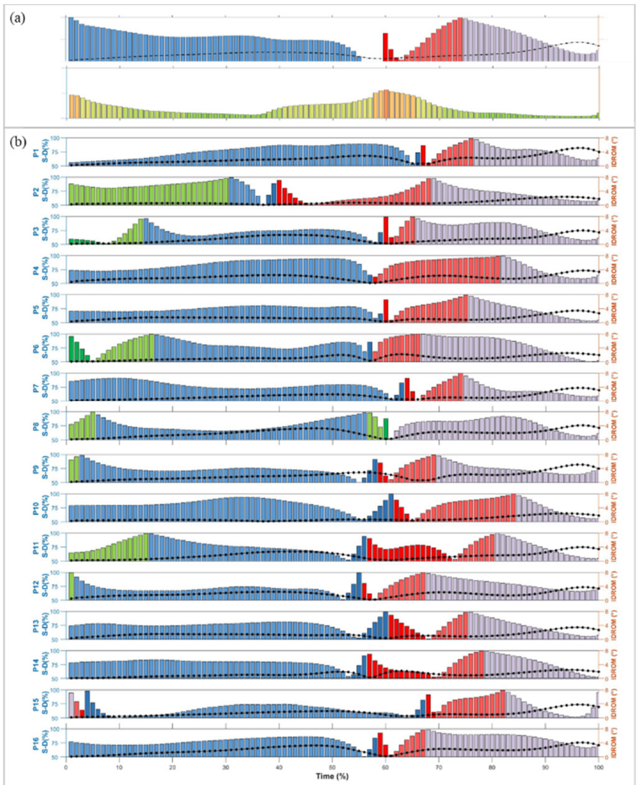

Figure 2: Coupling angle mapping (coordination pattern classification: colour-scale, Figure 1c), segmental dominancy (bar height, 50-100%) and dominant segment inter-data point range of motion (IDP-ROM: dotted line, 0-8°) profiling of thigh-shank coordination in the sagittal plane: (a) group means (top) and inter-individual coordination variability (bottom); (b) individual participants ordered from highest to lowest jump height.

Conclusions

Group-level analysis of CMJ coordination and control masks important inter-individual variation in movement strategies.

References

[1] Raffalt PC et al. (2016). *Hum Mov Sci*, **46**: 63-77.
[2] Needham RA et al. (2020). *The Foot*, **44**: 101678.