GRASPING PATTERNS AND FORCE PRODUCTION ON COMMON CLIMBING HOLDS DIFFER AMONGST EXPERT CLIMBERS

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INTRODUCTION
Rock climbing is becoming both accessible and popular amongst a broader population base [1]. This increasing participation has been matched by an increasing injury rate, particularly injuries to the distal upper extremity [2]. The most common climbing injuries occur in the finger flexor tendon pulleys, which can be overloaded to failure by acute excessive force in compromised finger postures [3]. Despite this risk, little is known about either variety or consistency of hand postures employed in climbing [4]. The purpose of this study was to qualify hand posture behaviours and force production amongst expert rock climbers.

METHODS
Thirteen expert climbers (self-report able to climb a 5.10a rated route; 7 male; 23.3 +/- 1.2 years old) performed grasping trials on 5 common indoor climbing holds (“pinch”, “sloper”, “crimp”, “pocket”, “jug”) mounted 25 cm along the stationary horizontal lever arm of a Lido WorkSET II dynamometer (Fig. 1; Loredan Biomedical). Vertical height of the apparatus was set such that the middle phalanx of the fully extended middle finger of the right hand just touched the hold anchor bolt while the subject was on both knees. 10 trials were performed per hold, with peak grasp moment measured in each while the subject rose from kneeling to standing while grasping the hold. Close-up images of grasp pattern were also video recorded in two planes (frontal from posterior, transverse from superior) for all trials, using an angled mirror [Fig. 1]. Force produced in each trial (as a percentage of body weight) was calculated for each subject, and subjects were sub-grouped for each hold type based on their preferred grasping pattern. Mean force production for hold-specific sub-groups were determined and compared.

RESULTS
Alternative grasping behaviours were observed for each hand hold type except the “jug” (Table 1). Different grasp postures were also associated with different force production levels. Examples of climbing grasp behaviour alternatives for the pinch grip are shown in Figure 2.

DISCUSSION & CONCLUSIONS
Expert climbers do employ different grasping patterns that produce different forces on different climbing holds. The disparity in behaviour may reflect differences in learning, ability, or in perception of appropriate grip force safety margin [5]. In situ or in vivo models of climbing grasp kinetics and finger flexor tendon pulley injury risks need to consider the variability of climbing grasp behaviour.

REFERENCES