A COMPARISON OF BARBELL TRAJECTORIES BETWEEN SUCCESSFUL AND UNSUCCESSFUL POWER CLEAN ATTEMPTS

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INTRODUCTION

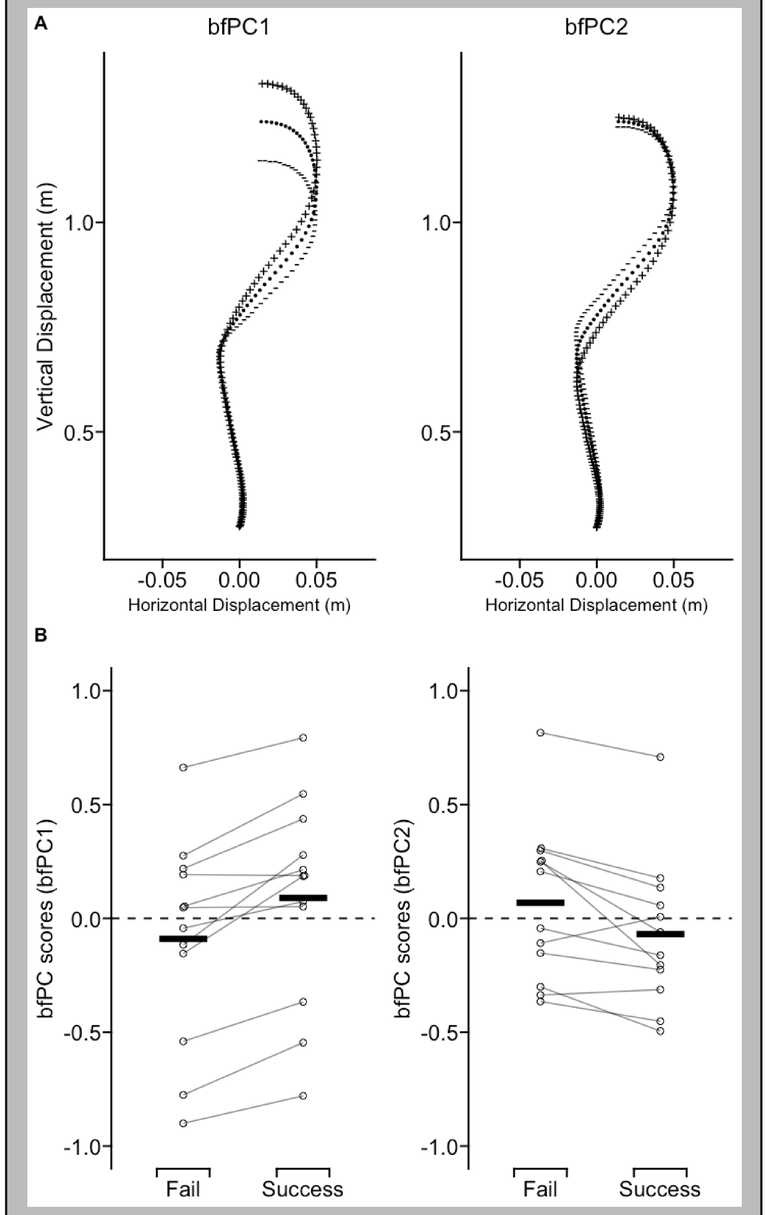
The trajectory of the barbell during the performance of weightlifting movements is one of the most common variables analysed when evaluating weightlifting technique because of its association with weightlifting performance (1). However, it remains unknown whether the patterns of the barbell trajectory during the power clean are associated with successful and unsuccessful attempts.

The purpose of this study was to determine the relationship between barbell trajectory and successful and unsuccessful power clean performance.

METHODOLOGY

Twelve strength-power athletes (10 males, 2 females; mean ± SD; height: 1.77 ± 0.10 m, body mass: 85.8 ± 17.3 kg, age: 27.9 ± 5.0 years), with the ability to power clean ≥1.0 times their body mass (relative one repetition maximum [1RM]: 1.18 ± 0.17 kg·kg^{-1}) were recruited for this study. All subjects completed a standardized 1RM power clean test. Following a series of warm-up sets, subjects performed a maximum of five 1RM attempts, each separated by three-minutes of rest. Barbell trajectories from the heaviest successful lift and the heaviest unsuccessful lift were tracked using a 3D motion capture system and then extracted for further analyses. Bivariate functional principal component (*bf*PC) analyses were performed to extract two *bf*PCs that accounted for most of the variances in barbell trajectory data (85%), with *bf*PC scores extracted for statistical analysis (2). Statistical analyses included dependent *t*-tests to examine differences in *bf*PC scores between successful and unsuccessful power clean lifts.

FIGURE 1



(A) Ensemble average barbell trajectories are represented by the black line. The + and – symbols respectively represent the effect of positive and negative bfPC scores on barbell trajectories, indicating the variation accounted for by a specific pattern.
(B) Differences in *bf*PC scores from each *bf*PC between successful and unsuccessful power clean lifts.

RESULTS

There were significant differences in *bf*PC scores from the first bfPC ($p < 0.001$) and the second *bf*PC ($p = 0.008$) between successful and unsuccessful power clean lifts (Figure 1B). The first *bf*PC extracted from the barbell trajectory data captured variations related to barbell height during the second pull and the turnover phase of the power clean (Figure 1A), with unsuccessful lifts likely to display a lower barbell height during these phases compared to successful lifts. Similarly, the second *bf*PC captured variations related to barbell height during the transition phase of the power clean (Figure 1A), with unsuccessful lifts likely to display a lower barbell height during this phase compared to successful lifts.

CONCLUSIONS

The results of this study suggest that lower barbell heights during the transition, second pull and the turnover phases were associated with unsuccessful power clean performance.

PRACTICAL APPLICATIONS

It is recommended that coaches and athletes emphasize maintaining a high vertical barbell displacement during the transition phase, likely resulting in higher barbell heights during the second pull and turnover phases. This approach may increase the likelihood of successful power clean performance.

REFERENCE

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