PROPULSIVE FORCE-TIME CHARACTERISTICS DURING ACCENTUATED ECCENTRIC DUMBBELL COUNTERMOVEMENT AND REBOUND JUMPS USING VARIOUS LOADING SCHEMES

B.A. Foster[1], E.T.A. Audley[1], J.B. Chard[1,2], A.E. Sundh[1,3], C.J. Cantwell[1,4], C.B. Taber[5], T.J. Suchomel[1]
[1]Department of Human Movement Sciences, Carroll University, Waukesha, WI, USA

Introduction

Accentuated eccentric loading (AEL) is hypothesized to induce unique neuromuscular and molecular responses due to within-set potentiation effects (2). AEL is an advanced method of training that utilizes heavier load magnitudes during the eccentric action compared to the concentric action in a complete stretch-shortening cycle without interrupting the fluidity of the movement (2, 5). Sheppard and colleagues (4) demonstrated that AEL jump training may lead to longitudinal improvements in jump height and power output, providing supporting for this training method. In addition, Gross et al. (1) indicated that repeated AEL jumps may be maximized within a commercial device. Given that these devices are not always available, further research investigating the use of dumbbells should be completed. The purpose of this study was to examine and compare the propulsive force-time characteristics of the AEL CMJ and subsequent rebound jumps (RJ) using different loading methods across multiple sets.

Methods

- Resistance-trained men (n=9, age = 25.8 ± 5.0 years, height = 173.2 ± 7.9 cm, body mass = 76.3 ± 9.5 kg, relative one repetition maximum [1RM] back squat = 2.0 ± 0.3 kg/kg) and women (n=9, age = 22.4 ± 2.1 years, height = 168.0 ± 8.1 cm, body mass = 70.4 ± 8.3 kg, relative 1RM back squat = 1.4 ± 0.3 kg/kg) participated in four total sessions.
- The first session included a 1RM back squat followed by familiarization with AEL CMJ followed by RJ.
- The three subsequent sessions required the subjects to perform three sets of a single AEL CMJ with dumbbells equating to either 20% body mass or 20% of their 1RM back squat or with no load followed immediately by four RJ.
- Each jump was performed on a force platform and the raw force-time data were used to calculate CMJ and RJ propulsive mean force (PMF) and duration (PD). The CMJ and average RJ performance within each set were used for statistical comparison.
- A series of 3 (condition) x 3 (set) repeated measures of ANOVA were used to compare BMF and BD for both the CMJ and RJ.

bfoster@carrollu.edu

Results

Table 1. Accentuated eccentric loaded countermovement (CMJ) and rebound jump (RJ) propulsion force-time characteristics (mean ± standard deviation).

	% BODY WEIGHT				% 1RM BACK SQUAT				CONTROL			
SET	CMJ* PMF (N/kg)	CMJ* PD (s)	RJ PMF (N/kg)	RJ PD (s)	CMJ PMF (N/kg)	CMJ PD (s)	RJ PMF (N/kg)	RJ PD (s)	CMJ* PMF (N/kg)	CMJ*[a] PD (s)	RJ PMF (N/kg)	RJ PD (s)
1	19.7 ± 2.4	0.22 ± 0.05	32.1 ± 5.0	0.13 ± 0.03	18.7 ± 1.6	0.17 ± 0.06	32.8 ± 4.2	0.12 ± 0.02	21.4 ± 2.4	0.25 ± 0.05	31.9 ± 4.8	0.14 ± 0.05
2	19.7 ± 2.3	0.22 ± 0.04	31.9 ± 4.8	0.13 ± 0.03	18.9 ± 2.2	0.17 ± 0.6	32.0 ± 4.3	0.13 ± 0.03	20.3 ± 5.6	0.24 ± 0.06	31.9 ± 4.4	0.13 ± 0.05
3	19.6 ± 2.6	0.21 ± 0.04	31.3 ± 4.6	0.13 ± 0.03	18.7 ± 1.8	0.17 ± 0.5	32.8 ± 4.1	0.12 ± 0.02	20.0 ± 5.6	0.25 ± 0.05	32.0 ± 4.4	0.13 ± 0.03

*= significantly greater than % 1RM back squat condition (p<0.05)
a= significantly greater than % body weight condition (p = 0.002)

Figure 1. Bottom position of descent of AEL jump.

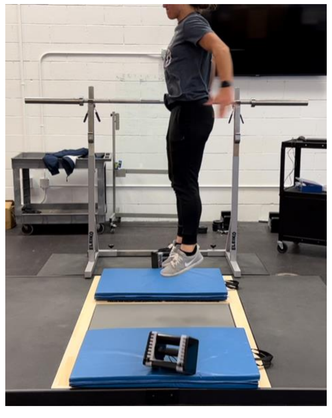

Figure 2. Propulsion and flight of initial AEL jump and RJ.

Conclusions

- Greater CMJ PMF and PD magnitudes were produced during the % body weight and control conditions compared to the % back squat condition.
- There were no differences in RJ PMF or PD between conditions.

Practical Applications

- CMJ with no load can provide an increased propulsive stimulus via greater PMF and PD compared to AEL CMJ.
- A similar training stimulus can be provided across multiple sets using either 20% of an individual's body weight or 1RM back squat for AEL CMJ.
- Because a similar RJ propulsive stimulus was shown following a CMJ appeared across loading conditions, practitioners may consider splitting these exercises as no additional performance benefit was provided.

References

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