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The Practical Utilization of Augmented Eccentric Loading

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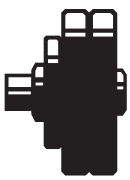

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Eccentric muscle actions have considerable differences from concentric muscle actions. It has been demonstrated that the neuromuscular system can produce more force in eccentric actions, and at the same time have less electrical activity as measured by Electromyography (EMG) (11). The practical application of these differences manifests itself in the realization that the loads used for resistance training are limited by concentric strength. Augmented Eccentric Loading (AEL) attempts to apply overload to the neuromuscular system by applying an increased eccentric load immediately followed by concentric actions with a reduced load.

The chronic effects of augmented eccentric loading on muscle strength have been demonstrated in several studies, most showing that the strength gains are similar to or greater than traditional loading (1,3,4,5,7). Other methods of applying AEL are to acute strength performance, or acute high-velocity performance, such as jumps or throws (2,9,10). The sheer number of acute training variables that can be manipulated in an AEL protocol makes it difficult to draw clear conclusions on its efficacy for acute performance, with both successful, and equivocal findings (2,9,10). However, it seems the existing body of literature suggests that AEL may be a worthwhile inclusion to the training of athletes.

Several methods of AEL for acute performance have been suggested (8). The most common way to apply AEL is the use of depth jumps. By dropping from a box, the mass of the body is allowed a longer time to accelerate, and thus a greater impulse is needed to change direction of the center of mass of the body upon contact with the ground. This method is popular, as it forces the individual to have a high rate of force development because the time to develop enough force for the jump is finite. However, the high rate of loading in these types of jump is not always desirable, and other methods of applying a supramaximal eccentric load are available.

Other than the application of increasing drop heights, AEL for jumps may be accomplished by holding dumbbells or kettlebells in the hands that are released at the bottom of the range of motion (ROM). This allows the concentric portion to be loaded with only body mass (Figure 1). It should be noted that safety must be addressed so that the implements do not interfere with the jump landing. Elastic bands can also be used, and with the help of others the band tension can be released at the bottom of the ROM; again allowing for reduced load in the subsequent concentric action (8). A sample plyometric training program utilizing AEL is seen in Table 1.

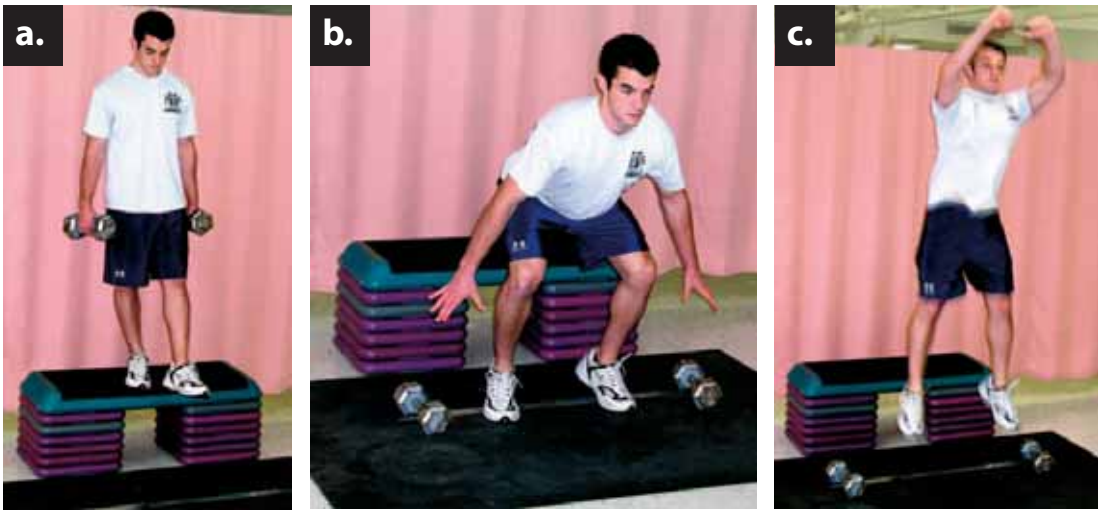

Figure 1:
Dumbbell AEL Depth Jumps (8).
(a) Beginning of dumbbell depth jump. (b) Landing phase of dumbbell depth jump. (c) Jumping phase of dumbbell depth jump.

Table 1: Sample Plyometric Training Program Using AEL (8).

Example of Plyometric Program Utilization Augmented Eccentric Loading		
Weeks	**Dumbbell Load**	**Elastic Load**
Training Block 1 Week 1 – 4	Depth landings with Dumbbels 15 – 30 total jumps 1 – 3x per week	Depth landings with band tension 10 – 20 total jumps 1 – 3x per week
Train Block 2 Week 5 – 8	General Low-Intensity jumping and bounding exercises	General Low-Intensity jumping and bounding exercises
Training Block 3 Week 9 – 12	Depth jumps with dumbbells 15 – 30 total jumps 1 – 3x per week	Depth jumps with band tension 10 – 20 total jumps 1 – 3x per week
Training Block 4 Week 13 – 16	General Low-Intensity jumping and bounding exercises	General Low-Intensity jumping and bounding exercises
This program may be repeated up to 3 times during the training year. Depth landings are performed exactly the same as depth jumps, without the concentric jump.		

Weight releasers are devices that can be suspended from the barbell and loaded with weight (Figures 2 and 3). Their design allows for adjustments to the ROM, so that the bottom of the ROM will cause contact with the weight releaser and the floor, thus removing the extra load and allowing for a concentric action with less load. These devices have been used successfully in several investigations (2,9,10). Since these devices may be somewhat uncommon, other methods may also be used in a similar manner. Empirically, some have used a power rack and spotting pins to allow the load to be suspended for a short period of time at the bottom of the ROM, in which spotters can remove some of the load from the barbell and allow for a lighter concentric action. This may be useful for doing consecutive AEL repetitions, but the time between the eccentric and concentric actions as well as the requisite coordination between spotters and the athlete may make this method of training more difficult to implement. Recommendations for loading with weight releasers are included in Table 2.

Figure 2: Weight Releaser (8).

Figure 3:
Weight Releaser (8).

(a) Beginning of jump squat with weight releasers. (b) Jumping phase of jump squat following the release of the weight. (c) Landing phase of jump squat with weight releasers.

Table 2: Recommendations for Loading Weight Releasers (8).

Recommended Parameters for Weight Releasers Relative to Concentric 1 Repetition Maximum				
	Barbell Load	**Releaser Load**	**Total Repetitions**	**Rest Between Repetitions**
Maximal Eccentric Loading	75 – 85%	40 – 55%	5 – 10	45 – 90 seconds
Near-Maximal Eccentric Loading	65 – 75%	25 – 40%	10 – 15	30 – 60 seconds
Submaximal Eccentric Loading	50 – 65%	10 – 25%	15 – 20	15 – 30 seconds

Understanding the unique force generating characteristics of eccentric muscle actions is a key component in optimizing neuromuscular adaptations to training. The previously mentioned training means may offer coaches and athletes a new method to help them reach their performance goals. While research in this area is sparse, this type of loading still allows for overload, and at the very least is a unique training stress that can be easily implemented into an athlete's training program.

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