

## Lower-Limb Amputees in Olympic Weightlifting

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**Abstract:** The coach serves an integral role in shaping the youth sport experience. For athletes with disabilities, participation in sports may be a negative experience because their coach may misperceive or misunderstand their behaviors. More educational material about coaching adaptive athletes would help bridge the information gap between weightlifting coaches and the adaptive community. Because the number of adaptive athletes in the sport of weightlifting is steadily rising, it is becoming increasingly important that coaches of these athletes understand how they can facilitate the athlete's lifelong enjoyment of the sport. Coaches should not be intimidated by adaptive athletes. Due to the unique nature of individual circumstances, it can be difficult to generalize about the most effective ways to train adaptive athletes. In recent years, USA Weightlifting (USAW) has introduced measures designed to increase accessibility of the sport for disabled athletes. These measures are summarized, analyzed, and presented in this article in a way that the authors are able to make training recommendations for athletes with lower-lib amputations. In addition, the psychological aspects of adapted weightlifting are briefed and analyzed culminating in recommendations for athletes engaging in weight training and coaches who work with athletes with amputation.

**Keywords:** Amputation, Weight training, Strength coaching, Adaptive sport

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### 1. Introduction

The academic and practitioner-based literature on coaching athletes with disabilities is relatively novel, but researchers are becoming increasingly interested in improving this area [1]. A recent review of literature suggests that, although research into coaching science and education had increased [2, 3], there is still a significantly noticeable lack of available research informing coaches of athletes with disabilities how to best apply their practice [4]. The coach serves an integral role in shaping the youth sport experience. For athletes with disabilities, participation in sports may be a negative experience because their coach may misperceive or misunderstand their behaviors [5]. This misunderstanding is recognized both by the athletes and the coaches themselves; recent research determined that a high majority of coaching educators did not believe that their preservice training adequately prepared them to work with athletes who have disabilities [6].

With the number of adaptive athletes in the sport of weightlifting rising steadily, it is becoming

increasingly important that the coaches of these athletes understand how they can facilitate the athlete's lifelong enjoyment of the sport. Due to the unique nature of individual circumstances, it can be difficult to generalize about the most effective ways to train adaptive athletes. This steepens the learning curve for coaches who are new to working with adaptive athletes and may cause some reservations. The education of weightlifting coaches is imperative to their comfortability and efficacy in coaching adaptive athletes. Unfortunately, there are relatively few resources available to further their understanding of adapted weightlifting. Coaches can be intimidated by their first adaptive athlete. It is an unknown realm to most coaches, which can discourage them from working with talented adaptive athletes. The present article seeks to provide cursory information about coaching lower-limb amputees in weightlifting in the hope that coaches will be more willing to work with these athletes in the future.

## 2. Current State of Adaptive Weightlifting

In recent years, USA Weightlifting (USAW), the nation's governing body for the sport of Olympic weightlifting, has introduced measures designed to increase accessibility of the sport for disabled athletes. This is in step with their stated mission to "support, promote, and educate a diverse and inclusive community of weightlifting and the use of the barbell in the United States," [7]. USA Weightlifting's competition accommodations for blind, deaf, amputee, and paraplegic athletes can be found on their website [8]. The accommodations allow for amputee athletes to perform single-arm or single-leg snatches and clean and jerks. There is no mention of allowing the use of adaptive equipment (straps, bands, harnesses, etc.) in the accommodations, but it is worth noting that USAW has historically allowed adaptive competitors to use their adaptive equipment in the past. This seems to be considered on a case-by-case basis.

A number of adaptive CrossFit athletes have discovered creative ways to complete a snatch and clean and jerk. There have also been many adaptive competitors at USAW events in the past. However, participation of disabled persons has been limited in the sport of Olympic weightlifting. This may be due in part to several factors. Poor accessibility of facilities, lack of transportation, lack of peers to train with, lack of knowledge about the sport, and lack of coaches willing to work with adaptive athletes may all

contribute to the comparatively low turnout in the sport.

## Training Considerations

In order to perform the snatch or clean and jerk, amputee athletes must deviate from the most accepted techniques. Coaches should use their understanding of the movements to assist the athlete in creating alternate movement patterns that suite their needs. Above the knee amputees may not be able to pull the barbell off the floor or squat to parallel while receiving the bar. To this athlete, a block power clean/snatch would offer the most training stimulus and allow them to perform the movement. This approach to modifying the classic lifts can be applied to a wide array of situations. Below the knee amputees may be able to pull the bar off the floor, but not be able to receive the bar in a full depth squat. A power variation will be necessary for this athlete.

For lower limb amputees, coaches may find that power variations of the classic lifts are often the most efficient way to earn three white lights. Power variations are very similar to the classic lifts, only differing in the height at which the athlete receives the bar. In a power clean or snatch, the bar is fixed in the front rack (clean) or overhead (snatch) at or above a parallel squat. As the coach, it's your job to ensure your athlete performs that variation to the best of their ability on the competition platform. There are ways to more efficiently train power variations that should be kept in mind when programming for these athletes. In all weightlifters, but especially those using power variations in competition, training rate of force development is critical to maximizing upward velocity on the bar. Since the athlete's prosthesis limits the depth to which they can receive the lift, developing vertical speed on the bar should be a focal point for the program. The faster the bar is moving upward when the athlete begins to pull under, the higher it will ultimately travel, giving the athlete more time to pull themselves under. To bias the athlete's program towards developing power, coaches should focus on "speed strength" and "explosive strength" [9]. Increases in absolute strength will come with increases in speed and explosive strength in untrained lifters. As an athlete becomes more advanced (i.e., their absolute strength is increased), "explosive strength must be trained directly rather than relying on increases of absolute strength," [9]. In other words, beginners will benefit greatly by increasing their absolute strength. This will translate well to the explosive strength

needed to perform a heavy power clean or snatch. However, a more advanced athlete will not see the same transfer from their absolute strength to their explosive strength. The explosive strength deficit (ESD) refers to the amount of an athlete's strength that is inaccessible due to the high contraction speed and transience of the movement. These quick movements do not leave enough time for muscle tissue to generate maximal force, which takes between 0.3-0.4 seconds [10].

The power clean from blocks (AKA block power clean) is a popular exercise used by athletes to train rate of force development. Pulling blocks are used to position the bar at or just above the knees at the beginning of the movement. The athlete braces their core and initiates the lift off the blocks, receiving the bar above parallel. Beginning the movement above the knees presents a few key benefits to the lower limb amputee. First, it allows them to set up in a position that is more accessible, and likely more comfortable, than starting from the floor. If an athlete's knee flexion is limited by a prosthesis, they may have to compensate for that lack of flexion somewhere else in their body. For example, they may not be able to quite reach the bar without rounding their back. Loading this compensated position may cause pain or injury to the athlete and should be avoided. Initiating the movement from the blocks can allow the athlete to properly breathe, brace, and set themselves up for a challenging lift. Allowing the athlete to set themselves in a more stable position offers advantages beyond simply increasing the safety of the movement. Bracing the trunk has been shown to increase muscular excitability, meaning that the athlete can generate more force during the lift [10].

Secondly, pulling from blocks offers simplicity. Often athletes will get themselves out of position when the bar is around knee height. This error causes the athlete to be out of position during the second pull and extension and dramatically reduces the athlete's odds of completing the lift. Starting from blocks above the knee allows the athlete to completely eliminate the pull from the floor to the knee and allows the coach to make corrections to their above-knee position before initiating the movement. The power clean from blocks requires a high-power output to impart enough speed on the bar to elevate it to a receiving position above parallel. This makes it one of the most effective Olympic movements at training an athlete's rate of force development. As discussed previously, if the athlete is using the power clean and power snatch

variations in competition, their ability to accelerate the barbell will be a key element to their success.

Since the athlete must receive the bar above parallel in power variations of the classic lifts, they must have the ability to absorb the downward force from a suspended barbell. Ideally, the athlete would fix the bar overhead or in the front rack at its highest point before it begins its descent. Doing so requires less force to stop its downward momentum. Depth drops are a simple exercise that most lower limb amputees could use to train their ability to absorb force. A depth drop is performed by stepping off a plyo-box and absorbing the impact against the ground by bending at the knees and hips, landing in an athletic stance. A jump can be added after landing, either from a static position or as a continuation of the landing motion, which can help train the athlete's ability to generate force from a static position or utilize the stretch-shortening cycle, respectively. If the athlete is able to perform overhead barbell movements like the jerk, another approach to training force absorption can be used. Instead of using jerk blocks, which allow the athlete to drop the weight from overhead after completing a jerk, have the athlete take their jerks from a rack. After a completed jerk, the athlete must re-rack the bar on their shoulders before replacing it on the rack. The act of lowering the barbell from overhead and stopping its downward movement in the front rack position closely mimics the demands of a power clean turnover. The bar will be moving much faster when it reaches the athlete's shoulders when re-racking a jerk as opposed to receiving a power clean, making it a viable option for overloading that receiving position. Of course, the coach should be certain that the athlete can perform this or any other movement safely before asking them to execute it.

### 3. Psychological Aspects of Adaptive Weightlifting

As a weightlifting coach, you want your athlete to perform to the best of their ability on the platform. Programming, error correction, and counting attempts is only part of your job. To be successful, your athlete must not only be prepared physically, but mentally. There are a number of mental "tools" athletes can use to perform to their ability. These practices include positive self-talk, mental imagery, mistake coping, emotional arousal, attention focusing, and relaxation, among others. The psychology of athletes with disabilities has only been a prominent topic of research for the past 15 to 25 years [11]. During this time,

researchers have found that the overwhelming majority of psychological practices employed by able bodied athletes can be applied to disabled athletes with similar results [12].

While most psychological practices can be carried over to adaptive athletes, the implementation of mental practice may need to be modified based on the individual. Mental practice is “the systematic application of [motor imagery] for the cognitive rehearsal of a task in the absence of overt physical movements,” [13]. Vividness of imagery has been identified as a moderator of imagery effectiveness [14]. In a study conducted by Malouin and colleagues, vividness of imagery was diminished in amputees who imaged their lost limb (2009) [15]. In the same study, vividness of imagery was enhanced when participants used a prosthesis in place of the missing limb. Presumably, the use of that “limb” contributed to the vividness of it in imagery. This position is further solidified by the fact that able bodied athletes experiencing temporary disuse of a limb (e.g., a broken leg in a cast) experienced diminishing vividness of imagery for that limb [15]. With this in mind, the author recommends that the athlete wear the prosthesis they will train and compete in as much as practical. This should enhance their ability to visualize themselves using the prosthesis when performing sport-specific tasks. If a prosthesis is not worn during training or competition, which is specifically allowed at USAW meets, it is recommended that the athlete not incorporate a prosthesis or their full limb in their mental imagery. Rather, the athlete should image themselves in the state they will compete in. For a lower limb amputee, this would be with a single leg with no prosthesis. Accurate imagery allows the athlete to more easily link visualization with reality.

#### 4. Conclusion

Coaches should not be intimidated by adaptive athletes. The athletes themselves have been overcoming challenges their whole lives and may prove to be the best resource for you as a coach. By working closely and consulting with the athlete, they may be able provide you with the insight you need to get started. As you start coaching them during training sessions, you can both explore unique ways for them to develop as a weightlifter. This collaboration, as well as the information shared in the present article, should be of assistance to you as you begin this journey with your athlete. For coaches seeking more information or formal training on coaching adaptive athletes, visit the

Adaptive Training Academy online at <https://www.ata.fit/>. USA Weightlifting

USA Weightlifting has had an impactful role in the inclusion of adaptive athletes in the sport of Olympic weightlifting. However, more educational material about coaching adaptive athletes would help bridge the information gap between weightlifting coaches and the adaptive community. The addition of information about adaptive equipment on the USAW website would be helpful for athletes seeking information on adaptive competition requirements.

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