



## Baseball Resistance Training: Should Power Clean Variations Be Incorporated?

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### Abstract

**Study background:** The power clean and its variations are prescribed by many collegiate and professional strength and conditioning coaches in order to train lower body muscular power. Lower body muscular power is an essential component to the overall performance of athletes in their respective sports. Although baseball is a sport that requires lower body power to be successful, it has not followed the trend of other sports that use Olympic lifts and their variations to train lower body power. Speculation leads practitioners to believe that baseball players consider Olympic lifts to be harmful to their shoulders and wrists because of the traditional over-head catch position of the snatch and jerk and the catch position of the power clean respectively. There are several power clean variations that produce high amounts of lower body power and may decrease the chance for injury to the shoulders and wrists. The high pull, jump shrug, and mid-thigh pull are three power clean variations that are used in the teaching progression of the power clean. Previous research indicated that the high pull, jump shrug, and mid-thigh pull can produce high amounts of lower body power that may be superior to a power clean variation that includes the catch phase. Because of the simplistic nature of these variations, it is likely the chance of injury to the shoulders and wrists will decrease.

**Conclusion:** If there are power clean variations that can produce high amounts of lower body power and decrease the risk of injury to the shoulders and wrists of athletes, baseball strength and conditioning coaches should not be so quick to exclude all power clean variations from their strength training programs. Baseball strength and conditioning coaches should consider implementing the high pull, jump shrug, and mid-thigh pull into their strength training regimens.

### Keywords

Resistance training; Baseball; High pull; Jump shrug; Mid-Thigh pull; Power clean variations

### Abbreviations

PC: Power clean; HC: Hang clean; HP: High pull; JS: Jump shrug  
MTP: Midthigh pull

### Introduction

The power clean (PC) and its variations are used in many collegiate and professional resistance training programs to train lower

body muscular power [1-9]. These lifts are effective in that they allow an athlete to produce high amounts of power while using large lower body musculature. Muscular power is an essential component to an athlete's success in sports [2,4-13]. Because of its running, jumping, throwing, and hitting demands, it should come as no surprise that baseball requires both lower body strength and power in order to be successful. Traditional Major League Baseball resistance training programs highlighted the squat and lunge as the two most important exercises for strength/power development [14]. Furthermore, professional baseball strength and conditioning coaches identified other exercises such as the "leg press", "lat pull-down", "DB 1-arm row", "core exercises", "step ups", and "seated row" as some of the exercises that are typically used in their resistance training programs [14]. Despite the wide variety of sports that train with the PC and its variations, only 3 out of 21 (14.3%) Major League Baseball strength and conditioning coaches prescribed Olympic-style lifts for their athletes [14]. This is in contrast to the 91.3% of National Hockey League strength and conditioning coaches who prescribed Olympic-style lifts for their athletes [15]. Although both sports require high amounts of power to be successful, little or no literature exists in explaining why baseball does or does not use these exercises to train lower body power. Although not specified, speculation leads practitioners to believe that baseball players and their coaches consider Olympic lifts harmful to their shoulders and wrists due to the common over-head catch position of a snatch or jerk and hyper-extension of the wrist during the catch of the PC. However, if baseball strength and conditioning coaches are concerned about potential injuries that could occur while using the PC, it should be noted that there are several variations of the PC that may limit the stress placed on the wrist and shoulder while also providing a strong training stimulus that may improve lower body muscular power [1,2,16]. The purpose of this article is to provide a rationale as to why baseball strength and conditioning coaches should consider implementing PC variations into their strength training regimen and also to address why certain PC variations are somewhat non-harmful to the wrist and shoulder joints from an injury perspective.

### The Power Clean

The primary goal of training with the PC and its variations is to improve lower body muscular power by training the triple extension of the hip, knee, and ankle joints. Although lower body power can be enhanced using several different exercises, it has been suggested that athletes need to train with exercises that involve rapid acceleration simultaneously in multi-joint movements against resistance without the intent of decelerating to achieve the greatest benefits [17]. Olympic lifts and their variations allow athletes to accelerate their body against a resistance through the entire triple extension movement [4]. Compared to many other forms of resistance training, the magnitude of the concentric acceleration during Olympic lifts is superior. By performing Olympic lifts and their variations, it is likely that athletes will be provided with a superior training stimulus to improve lower body muscular power.

The PC and its hang clean (HC) variation are technical lifts that require athletes to catch the bar across their shoulders [3,5,9,12,18],

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similar to a front squat position. However, it is possible that baseball strength and conditioning coaches may have an issue with this final position. Furthermore, they may argue that the catch phase puts too much pressure and compression on the wrist in a hyper-extended position and also may cause excessive compression at the impact of the catch onto the clavicle and acromio-clavicular (AC) joint. Another argument may be raised during the catch position, as the excessive compression around the shoulder joint area may decrease the sub-acromial space resulting in shoulder impingement. However, these arguments have not been supported in the existing literature. As a result, baseball strength and conditioning coaches may eliminate the idea of using the PC and any of its variations in their resistance training regimen. However, this decision may be based on an assumption that all PC variations are injury prone exercises and should be avoided. Thus, baseball strength and conditioning coaches may overlook the potential shown by previous research of several other PC variations that are less technical, likely have less chance for injury, and may produce as much, if not more, lower body power than the PC [1,2] and HC [1,2,16].

### Power Clean Variations

Although the PC and its HC variation can be highly beneficial to an athlete's lower body muscular power, baseball strength and conditioning coaches may have an issue with the physical requirements of the catch phase of each lift (weight supported by the shoulders and wrists). The catch phase of the PC and HC requires the lifter to rapidly rotate their elbows under the bar, while projecting them forward and keeping them high, and catch the bar across their shoulders in a semi-squat position [3,5,9,12,18]. Due to the complexity of the catch phase, baseball strength and conditioning coaches may take comfort in knowing that previous research indicates that practitioners should substitute less technical exercises to train lower body power [4,10]. As previously mentioned, previous research suggests that there are several PC variations that are less technical lifts that may decrease the chance for injury occurrence and still provide a superior training stimulus as compared to the PC [1,2] and its HC variation [1,2,16]. Three variations used to teach the PC are the high pull (HP), jump shrug (JS), and midhigh pull (MTP) [3]. As sport scientists, it is our responsibility to inform strength and conditioning coaches of different exercises and training methods that will produce stronger and more powerful athletes. In regard to training baseball players, there is a need to educate baseball strength and conditioning coaches about the benefits of using the HP, JS, and MTP in order to train lower body muscular power. It should be noted that from an injury perspective, no current literature suggests that these variations will produce a similar or greater frequency of injuries.

### High pull

The HP can be simplified by stating that it is a PC without the catch phase. Previous research demonstrated that the HP produced greater power values at all relative loads examined as compared to the HC [16]. Briefly, the HP requires an athlete to explosively perform the triple extension of the hip, knee, and ankle joints, shrug their shoulders, drive their elbows upward, elevate the barbell to their chest height, and then guide the barbell down to the original starting position [5,18]. Because the HP eliminates the catch phase, the shoulders and wrists do not have to support at the weight at the end of the lift, indicating that this variation will likely not result in a similar or increased risk of injury to the wrist and shoulder joints. Therefore,

the wrist joints will not be put in a hyper-extended position and the AC region will be unaffected because the barbell will not impact the shoulders or clavicles. Like the PC and its HC variation, the HP can be performed from the floor (Figure 1) or from a hang position (Figure 2) respectively. If the strength and conditioning coach would like their athlete to perform the HP from the hang position, they are given two options. First, the athlete can perform the HP from a static position where the barbell starts from the power position, which is located below the athlete's waistline, on the upper portion of their thighs. From this position, the athlete can perform the triple extension movement, shrug their shoulders, drive their elbows upward, and elevate the barbell to their chest height (Figure 3). The other option involves starting from the power position and then performing a countermovement that has been previously described by Kawamori et al. [6]. From the power position, the athlete would lower the barbell down their thighs to a position just above knee level before returning to the power position and performing the series of events previously described to complete the lift. The only clear difference between these options is the use of the stretch-shortening cycle when using the countermovement.

### Jump shrug

Although no research has displayed an increased risk of injury when performing the HP, it is possible that baseball strength and

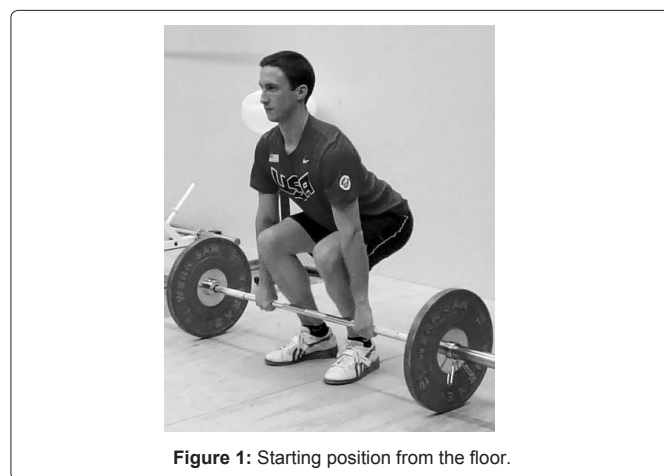


Figure 1: Starting position from the floor.

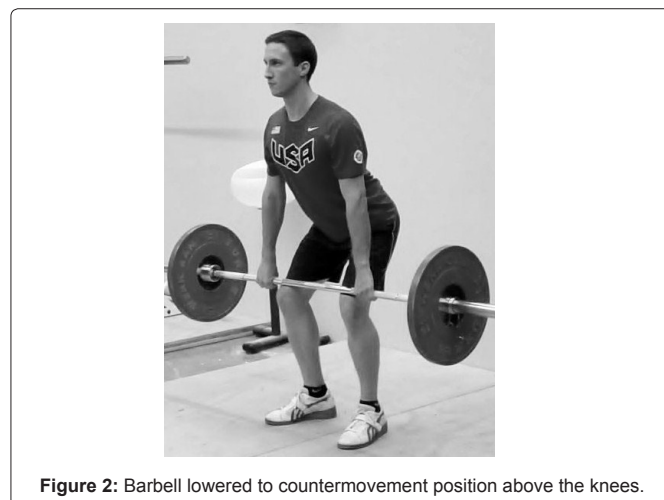


Figure 2: Barbell lowered to countermovement position above the knees.

conditioning coaches may view the eccentric deceleration phase of the HP to be a negative stimulus that would increase the strain on the body as the barbell would be lowered from a higher height. A second PC variation that further simplifies the second pull movement and eliminates the elevation of the barbell to chest height is the JS. Although this exercise is more simplistic than the PC, HC, and HP, previous research demonstrated that it was superior to both the HC and HP in power production at all relative loads examined [16]. The JS requires an athlete to explosively perform the triple extension movement and maximally jump with the barbell, shrug their shoulders, and land in an athletic position [3,5,18]. Similar to the PC, the JS can be performed from the floor. In addition, the JS can be performed from the hang position with or without a countermovement, similar to the HP. A benefit of the JS is its ballistic nature, in which it requires the athlete to leave the ground to complete the lift. Figure 4 illustrates the JS sequence. Furthermore, the wrist joints will stay in a neutral position throughout the entire lift resulting in even less strain than previously mentioned. In addition, the shoulder joints will not be required to elevate the barbell resulting in less production needed from that particular joint.

### Midhigh pull

For the baseball strength and conditioning coaches that would have an issue with the HP or JS, the MTP is yet another PC variation that produces high amounts of lower body muscular power [1,2]. In fact, the MTP may be considered the least technical exercise of those described within this article. Like the JS, the wrists will maintain a neutral position throughout the lift and the shoulders will not be



Figure 5: Sequence of the mid-thigh pull exercise starting from the power position.

required to elevate the barbell likely resulting in much less strain on both sets of joints. Previous research demonstrated that the MTP produced the greatest lower body power as compared to the PC, HC, and midhigh power clean [1,2]. The MTP begins in the power position as previously described above. From here, the athlete explosively extends their hips, knees, and ankles, and then shrugs their shoulders near the end of triple extension. To incorporate the stretch-shortening cycle, athletes can perform a countermovement as previously described. Figure 5 illustrates the MTP sequence.

### Should Power Clean Variations Be Incorporated?

Because power is an essential component to an athlete's success in sports [2,4-13], many strength and conditioning coaches use the PC and its variations to train lower body power [1-9]. Due to the complex nature of the PC and its HC variation, baseball strength and conditioning coaches may view all PC variations as exercises with a higher potential for injury. However, the HP, JS, and MTP are PC variations that may in fact limit the potential for injury to the wrist and shoulder joints because of the exclusion of the catch phase. Furthermore, previous research has displayed that these PC variations can produce high amounts of lower body power that are superior to PC variations that include the catch phase [1,2,16]. If certain PC variations can produce high amounts of lower body power and minimize the chance for injury, baseball strength and conditioning coaches should not be so quick to exclude all of the PC variations. Therefore, it is recommended that baseball strength and conditioning coaches should consider implementing the HP, JS, and MTP into their resistance training regimens.

### Conclusion and Discussion

Previous research indicates that there are several PC variations that are less technical exercises that will allow athletes to improve their lower body muscular power [1,2,16]. The HP eliminates the catch phase that is characteristic of the PC and HC, thus eliminating the compression placed on the wrist joint while it is in a hyper-extended position and the potential compression of the shoulder joint area that may take place during the impact of the barbell on the shoulders and clavicles of the athlete. In addition, the JS further simplifies the second pull movement by eliminating the elevation of the barbell and requiring the lifter to jump and shrug with the load. Finally, the MTP simply requires the lifter to extend their hips, knees,



Figure 3: Sequence of the high pull exercise starting from the power position.



Figure 4: Sequence of the jump shrug exercise starting from the power position.

and ankles, and shrug their shoulders. By simplifying the second pull movement and decreasing the amount of vertical displacement of the barbell, it is likely that the HP, JS, and MTP will decrease the stress placed on the wrists and shoulders.

While potentially decreasing the stress placed on the wrists and shoulders, previous research indicates that the HP [16], JS [16], and MTP [1,2] are exercises that produce high levels of muscular power. Furthermore, by using the HP, JS, and MTP in resistance training regimens, baseball players could see improvements in things such as bat velocity during hitting, a catcher's pop time to second base, their explosiveness while stealing bases, etc. In order to enhance the overall performance of baseball players while implementing exercises that may decrease the amount of stress placed on the shoulder and wrist, baseball strength and conditioning coaches should consider implementing the HP, JS, and MTP into their strength training regimens.

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