

The Crane Dip and Other Pistol Variations

Steve Cotter

When it comes to human movement in the context of both daily activities and athletic potential, there are unique physical skills that are useful and worth the investment of time and energy to develop. Some come very easily and naturally, and others demand greater effort and practice to develop the skill. One such worthwhile skill is the ability to balance on one leg and squat. The one-leg squat, popularly called the “pistol,” is great for developing improved balance, lower-body strength, range of motion, and agility.

Historically, this movement has been associated with martial arts. My introduction to this sort of training was in Chinese boxing and what we call the crane dip, which is a more controlled and graceful (and difficult) version of the pistol. It is part of the physical conditioning methods that beginners should study and train to set a strong foundation. It requires what I like to call degrees of freedom of motion. To be as balanced in a low or a mid-range position as in a high position and to be able to move fluidly from a dynamic to a static control and back again in an unrestricted environment are very useful characteristics to develop.

The crane dip is distinguished from the pistol in a few important ways. While the pistol is performed with the non-working leg extended out in front of the body, floating in the air, the crane dip is performed while holding the extended leg with your hand. This support from the hand allows you to keep your body more upright than is possible with the pistol, because the support hand provides a counter-balance for your extended leg to press against, and also give you greater balance and stability throughout the entire range of motion.

Before the advent of firearms, when martial arts were truly forms of warfare and not sport, a fighter had to develop the skills to slide under a spear attack or jump over a low sword attack while also able to stand a strong position against a bludgeon attack. Versatility and the ability—and agility—to spring in and out of position were essential to survival in such an environment.

The crane dip is a great name for this exercise because it involves not only the basic movement of squatting down on one leg, but doing so with fluidity and poise and control, like the motion of its namesake bird. It is not hurried or uneasy or tense. It is smooth and efficient. Yet the crane can strike forcefully from this position on one leg at any time. This is the strength and control and agility that we seek through practicing this exercise.

There are wide-ranging applications of the movement in daily life. For example, where you to slip on ice or take a misstep while stepping off a curb, the ability to catch your balance and absorb force on one leg could save you injury—and humiliation.

In athletic environments, being able to drop your center of mass quickly and easily while in transit will allow you to maintain good

positioning and keep you in play. Stability in a low position and flexibility in the ankles, knees, and hips will help you to attain superior leverage over your opponents. A key to leverage is to be low to the ground—having your center of mass closer to the base of support—while maintaining mobility, the ability to move in any direction.

For grappling sports, you may find yourself on one leg while your competitor tries to throw you or sweep you. When there is an attempt to take you down, if you can follow the force down under control on one leg, you will be in a position to counter-attack, because you will have maintained base throughout the entire range of motion.

In striking activities such as boxing and martial arts, to be able to thrust strongly off your rear leg will add power to your movements. When throwing kicks, it is essential to be stable while on one leg. The planted leg demands integrity of the joints of the feet, ankles, knees, pelvis and spine. The proper one-leg squat develops this sort of integrity.

Another benefit of crane dip strength is the relative ease with which you will be able to squat on two legs, once you are competent at squatting on one. The proprioceptive awareness developed in the joints of the lower body as a result of single-leg squat training will give you a sense of added control when you move to a double-leg stance. If you can do it on one leg, do you think you might be able to do it more easily on two? If you were to seriously injure a leg or a foot in an environmental hazard or a military operation, could you get yourself back to camp with the use of only one? The combined demands of stability and mobility throughout the entire range of motion of the joints make crane dip training more than worthwhile.

No single movement or exercise can develop every desirable physical attribute. There are certain “high-value” movements such as the Olympic lifts, kettlebell swings, deadlifts, and various gymnastic and martial-art-based bodyweight skills that offer more bang for the precious buck than the majority of exercise choices. In this case, the “buck” is time invested in training. If you are going to do it, know what you are getting out of it and why, and then select the most direct path. For developing low-line, low-body stability and mobility simultaneously, the crane dip meets that gold standard. It is a specific skill with far-reaching adaptability to practical applications and a variety of functional settings.

Common limitations and restrictions

Unless you are young, supple, and without any ingrained faulty movement patterns, chances are the first time you try to do a crane dip you will have some difficulties. Perhaps the downward

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portion won't be a problem for you. After all, gravity can be a big help on the way down, if you let it be. Getting back up, however, may prove to be a struggle initially. In other cases, you may have the power to drive up from the bottom, but tightness and the subsequent balance challenge makes you feel uneasy on the way down. You may have difficulty balancing in the position or a lack of flexibility that prevents you from extending your leg properly. Or perhaps, you just have no clue how to get started!

Before beginning to practice crane dips, the first thing to establish is the proper approach to take, so that you set the tone for a positive learning experience. In the case of the crane dip or any one-leg squat, the thing to keep in mind is that it is a squat.

At its simplest level, I teach that all forms of a squat are essentially the same. They all involve sitting the center of mass of your body over the base of support using flexion of the trunk and lower body, and then extending the trunk and lower body to finish or stand up from the squat. We know that definitions of what constitutes a squat can differ both in terms of practicality and tradition (for example, the different version of squats prescribed by some Olympic weightlifters and powerlifters). But on the most basic level, all squats have the same goal and general path. A person may contort his or her own body to "accomplish" a squat, yet the relationship of the center of mass to the base of support will remain constant in all versions, be it a power lifting, Olympic, overhead or one-leg squat.

So, a one-leg squat is just like any other squat. It is important to be aware of this because, psychologically, when someone moves from two legs to one, their idea about how to do the movement generally changes. It shouldn't. Oftentimes a beginner to the movement will change the strategy and become very concerned. Treat it confidently just as you would a squat with two legs. Your goal is to sit back and down and lower your center of mass over your base of support and keep it there throughout the entire motion. If you achieve that, you have the movement down.

I have found that there are generally two sets of limitations that prevent one from squatting well, whether with one leg or two. The first is a set of psychological barriers, and they are fear-based. To squat properly, you have to sit back, way back. Mankind has a resistance to "going horizontal," especially when moving the center of mass backward as if about to sit in a chair. This backward shifting of the center of mass alerts the body to the possibility of falling, and this is an inherent fear. We are vertically-oriented beings and, in most cases, function in our working and training environments in upright positions.

There is also the fear of the unknown. For a number of reasons (the lack of attention to free-weight movements and heavy lifting in national trainer certification and education programs; the subsequent shortage of mainstream trainers qualified to teach it;

the perception that it is dangerous or "bad for the knees"; the fact that the back side of the body is out of sight and therefore out of mind for many; etc.), plenty of gym-goers have never learned to squat. In fact, plenty have never even considered that it might be a potential or important part of their workout regimens. For them, the squat is unknown and therefore to be feared. This fear is one of the things that has to be overcome psychologically to prepare the body for an effective crane dip.

The second set of obstacles in the pursuit of a good squat are physiological. Some trainees will be hamstrung (as it were) by extreme inflexibility due to years of inefficient movement or, more likely, lack of functional movement at all. Residents of modernized nations have to overcome the handicap that has been created by our reliance on chairs. Most Americans, for example, probably spend the majority of their waking hours seated with the hips at roughly a right angle—at work, in cars, at the dinner table, when watching TV or working on the computer, and even when going to the bathroom. Over the years, this chronic posture tightens and shortens the hip flexors, and the discs and tissues of the low back become tired and rigid. This tension and shortening works down into the hamstrings and this chain of tension causes a lot of difficulties with squats.

Notice too that children have no problems squatting and no need for instruction; squats occur very naturally as a position for and for reaching things on the ground—often for prolonged periods. It is also striking to see the upright posture and easy, comfortable squats of field workers in less industrialized nations. They spend countless hours working in a full squat and thus do not lose the ability to function in that range of motion, which we all had naturally as young children.

The majority of physical limitations to mastering the crane dip are related to the shortening and tightening that occur over time if you don't make an effort to keep active and move through full ranges under load. In other words, if you exercise within a broad range of motion, you will have health and functional mobility.

Sometimes, restricted movement is due to injury, in which case a more systematic and incremental approach must be taken. The key lies in the progression. In certain cases, such as in the case of a knee reconstruction surgery or knee-replacement, the knee joint may be unstable and until you redevelop the joint integrity, and the crane dip may not be for you. (Though you can work on box squatting instead.) Whatever will enable you to progress is the right solution for you.

The rest is simply a matter of time and practice. Here are simple ways to build skill in the basic practice, with some more advanced variations to keep you interested.

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Preliminary stretches and warm-up movements

If you are dealing with some of the flexibility restrictions that make it hard to get into position (tight hamstrings, hip flexors, and lower back are the most common ones), here are some preliminary or warm-up movements that help prepare the weak links of the body for the crane dip. Trouble spots will vary from person to person. Some of you may have tightness in all of these areas initially, and so may want to go through all of these warm-ups; others will have no major limitations and can go straight into the crane dip.

Execute these movements in a circuit to get your body ready for crane dips:

1. Leg swings: Hold on lightly to something to keep upright and swing the leg forward and back to work into the hamstrings as you swing the leg forward, and into the low back and hip flexors as you swing the leg back. Keep the upper body upright. Try one or two sets of 20 to 30 easy reps, increasing the range in both directions as you get looser.

2. Overhead squat: With a PVC pipe or pole, do one or two sets about 10 overhead squats. If you're very flexible, graduate to feet together/hands together for deepest stretch.

3. Cobra stretch: For the lower spine. Lie on your belly with your arms bent and held in at your sides, palms and forearms flat on floor, palms just outside your shoulders. Keep the body from navel to feet on the floor and then, leading with the eyes, lift your upper body up and back and arch toward the ceiling. Hold at the top for a few seconds. Try two sets of 5 to 10 slow reps.



Leg swings



Overhead squat



Cobra stretch

Basic practice of the crane dip

To execute a Crane Dip:

1. Stand firm and shift your bodyweight over one foot (the left, for purposes of descriptions and photos in this article). Pick up your right foot with your right hand by reaching the hand around the outer edge of the foot so that the outer foot will be in the palm and the fingers will reach under the foot and pull it toward you (into a position of dorsiflexion). Your right knee will splay out to the right side and—unlike a regular two-leg squat—your hips will tuck under slightly (posterior pelvic tilt). The hand over the weighted leg will be pressing firmly against an imaginary wall to give stability to the working side of the body.



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Basic practice of the crane dip (continued...)

2. Keeping your right hand on your foot, stretch your right leg out straight in front you at a 90-degree angle from your torso. Using that outstretched leg as a counterbalance and pressing against the imaginary wall, sit back and down over the heel of the support foot and breathe into your belly (creating pressure with the diaphragm) as you descend to the full bottom position, keeping your right heel fully on the floor.

3. Stand up by pressing your right heel into the ground and reaching up with the top of your head, maintaining your grip on your foot with your right hand and pulling that foot back in toward your hips as you straighten your left leg and return to the starting position.



Progressions for working up to a complete crane dip

If you cannot yet complete a crane dip, here are some recommended progressions for working up to it incrementally.

Box squat / one-leg box squat

This exercise will help you get comfortable with the action of sitting back and down, it lets you working within a range of motion that you know you can complete.

1. Step in front of a wide-base box so that when you sit, your knees will be directly over your feet and your thighs will be at approximately 90 degrees in the seated position. Hold your arms out in front of your body to serve as a counterbalance and then, keeping your chest high, back upright, and feet flat on the floor, lower yourself to the box.
2. Press your heels into the ground and stand up as you exhale.
3. Repeat steps 1 and 2 while standing on one leg and extending the other leg straight out in front of you.

Start with a tall box and then, as you become more confident and stronger in the movement, decrease the height of the box or chair. When you are able to consistently one-leg squat onto a 12- to 16-inch box, you are ready for the next progression.



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One leg squat from a box

In this exercise, you will be completely unsupported from behind but without the flexibility demands of holding the free leg in front. This variation will enable you to build strength in the support leg. Plyo boxes are most convenient, but any box will do. You'll need an assorted collection of boxes from about 6 to 36 inches tall, in 6-inch increments.

1. Stand on top of the platform with the support foot near an edge so that the free leg can hang straight down; this will take away the demands of supporting and balancing the non-weighted leg, making it easier to train the hamstrings, glutes, and quads, even with less than optimal flexibility in the hip flexors and lower back. Keep the free leg slightly behind the working leg, so that the pelvis is neutral, making it easier for you to sit back and load the hamstrings more than the knee.

2. Sit back and down onto the heel of the working foot until the toes of the non-weighted leg reach the floor. Be sure not to transfer any weight to the non-working leg—keep all your weight over the squatting leg; the toes of the non-weighted leg serve only to guide your range of motion.

3. Stand up by pressing strongly through the heel and back up into the starting position as you exhale.

When you can do five strong reps on each leg, it is time to move up to a taller box. Once you are doing full range on a box that is tall enough to prevent your non-working leg from hitting the floor, you have enough strength that you should begin working on more challenging variations, such as weighted one leg squats and crane dips.



One-leg squat with a counterweight

If you have the strength and flexibility to perform the basic variations, but still have some difficulty with balance, the one-leg squat with a counterweight is just the ticket.

1. Stand on the working leg and extend the non-working leg straight in front of you at about waist level. Hold a moderate sized counter-weight (I suggest a medicine ball weighing 8 to 20 pounds, depending on your size and how much help you need). The heavier the counterweight, the easier it will be to keep your balance, up to a point. When it gets to be heavy enough to stress the arms and shoulders, the tension needed to hold it defeats the purpose of it serving as a counterweight and it becomes a grip and arm exercise to hold it in place. As you sit back and down, pull the ball (or weight plate or kettlebell) back against your body.

2. From the bottom position, extend the counterweight out in front of you at about chest height by thrusting your arms forward. The forward thrust serves to pull you forward.

As you improve with this variation, use a lighter and lighter counterweight. By the time you work down to about five pounds with good form, you are ready for the bodyweight-only crane dip.



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Advanced progressions

Once you have mastered the basics of the one-leg squat, you can begin to incorporate weight, depth jumps, and plyometric variations.

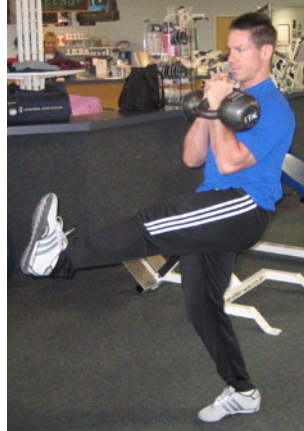
Adding weight to your frame

To do a weighted one-leg squat as a strength exercise, it is popular to grab a kettlebell and hold it out front. A good athlete can do this with a 70-, 88-, or even 106-pound kettlebell. However, I have found that the true test of one-leg squat strength as measured by poundage is to do the movement with weights in the rack position.

1. Clean two kettlebells to your chest, preferably of the same weight but it doesn't always work out that way. Sometimes you have to grab what is available. Extend one leg at waist level.

2. Sit back and down on the weighted leg. Inhale into your belly in the bottom position. With heavy weight, you will have to apply more tension; pull up your pelvic floor and brace your belly as for any heavy lift/

3. Drive up through the heel to stand as you exhale.



Plyometric variations

For advanced plyometric training, there is some value in controlled-depth jumps and box jumps with one leg. It builds confidence and it is a test of your ability to use one leg. It is not something I advocate as a major component of any athlete's training program. It is simply a specific test with specific value.

The alignment of the knee is crucial to healthy performance and longevity. To jump forward and down from height will put tremendous shearing forces on the patellar tendon and ligaments in the knee. A jump from any direction puts great force on the knee; however, I have learned how to stabilize in that movement by jumping sideways. The strength of the quadriceps and adductors are able to keep the knee in a vertical relationship with the foot, so the shearing forces are not overwhelming to the lateral and medial ligaments. Moreover, because you are not jumping forward, you can sit back with the hips and keep the center of mass over the base of support. This same alignment allows both expression of force and controlled absorption of force, which is then recycled again.



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Online Video

Depth Jump Pistols ←

<http://media.crossfit.com/cf-video/CotterJumpingPistol.wmv>

<http://media.crossfit.com/cf-video/CotterJumpingPistol.mov>

One variation of the one-leg squat is the depth jump pistol—an extreme version of which is demonstrated in the video clip. I do not advocate doing a depth jump pistol from the kind of height shown in the video. However, the skill of jumping up and down into a deep pistol from even very small platforms demonstrates and develops relevant athletic characteristics. It is a test and an illustration of acceleration and deceleration, and is a logical extension of mastering the basics. Specifically, the depth jump pistol demonstrates the significance of the deceleration component of applied force. The intense deceleration involved in controlling your body as you descend stores elastic energy prior to jumping again, which enables you to jump more powerfully.

There are certain “high-value” movements such as the Olympic lifts, kettlebell swings, deadlifts, and various gymnastic and martial-art-based bodyweight skills that offer more bang for the precious buck than the majority of exercise choices.

You may wish to begin practicing jumping pistols on much smaller rises and someday try a stunt like that, but I don’t recommend it as a regular practice. Make sure that you are extremely solid in all other variations first—and remember that I tried to talk you out of it!

Overall, remember to prioritize skill acquisition, precision of form, and fluid motion. Make mastering the crane dip a goal. It is good to practice some of the variations listed above, but don’t get too involved with extreme loading until you have gained base competency with the use of just your bodyweight. The exercise will pay large dividends

→ **Steve Cotter** is a renowned kettlebell instructor who teaches his unique blend of [Full Kontakt](#) kettlebell training throughout North America, Asia, and Europe.

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From the Snatch to the Clean

Mike Burgener, with Tony Budding

Over the past few months, we've taken you through a series of exercises designed to teach you the full squat snatch. This month, we're introducing the clean. This ordering was intentional. Anyone who can perform the snatch properly can perform the clean properly within a few quick steps. The opposite is not true. There are many folks who can clean properly who never learned (or can't easily learn) the snatch.

Success in all the Olympic lifts is based primarily on a single simple concept: generate momentum and elevation on the barbell (or whatever object is being moved). This momentum is generated by a violent vertical extension of the legs and hips. The exercises covered in the previous months' articles detail the proper development of this extension.

The mechanics of the first and second pulls are identical for the snatch and the clean. There are two main differences between the two lifts: the width of the grip on the barbell and the receiving position of the barbell. The clean grip is noticeably narrower than the snatch (see *CrossFit Journal* issue 52), and the receiving position is the front rack position instead of overhead.

Many folks ask if there is a Burgener warm-up for the clean. Technically, there is, but it is not necessary because the body very easily shifts the receiving position from overhead to the front rack. The rest of this article assumes that you have followed the sequences in the previous three articles and can perform a proper (not necessarily perfect) full squat snatch with at least a wooden dowel or piece of PVC pipe.

Front squats

After going through the Burgener warm-up, the first step in preparing to clean is to perform some front squats. The movement begins with the dowel resting on the shoulders in front of the neck, elbows up as high as possible, hands just outside the shoulders with palms up and fingertips holding the bar in place, and feet in the landing position (as described in issue 51). Take a deep breath and hold it throughout the movement. Your back should be set into position, with a good lumbar curve, abs tight, and weight firmly on the heels (see *CFJ* issue 4 for a thorough analysis of the squat). Descend into a full squat position until the hip joint is below the kneecap. Pushing into the ground through your heels, finish by standing upright into the starting position and exhale before resetting your position for a further repetition.

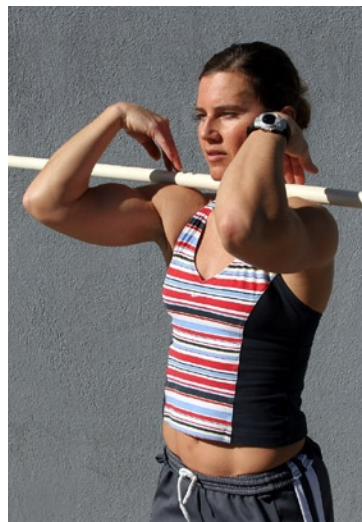
Some athletes will not be able to execute the front rack position without a weighted bar. For them, turning the hands over (i.e., with the back of the hand up and fingers down) while keeping the elbows up is an acceptable alternative for working with a dowel, as it allows the athlete to maintain proper elbow height and body position throughout the movement and puts the bar on the shoulders in a way that closely resembles the normal rack. Once a weighted bar is introduced, the palms should face up normally, with the bar held securely in place on the shoulders by the raised-elbow position, with just the fingertips on the bar. Crossing the hands and holding the opposite shoulder is not an acceptable alternative, as it does nothing to prepare the body to receive the barbell in the front squat position during the clean.



Front rack



Front squat



Front rack alternative



Bad front alternative

Online Video

Front squats

<http://media.crossfit.com/cf-video/JournalFrontSquat.wmv>

<http://media.crossfit.com/cf-video/JournalFrontSquat.mov>

From the Snatch to the Clean

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Clean drops

The next step in the progression is to perform clean drops. The starting position is the same as for the front squat, except that the feet are in the jumping position instead of the landing position. With a tight core, quickly drop (not jump) directly into the bottom of the front squat. There is no dip-drive or heave in this movement. As you are dropping, your feet will come off the ground just enough to move from the jumping to the landing position, but the body does not ever rise past the starting point. Care should be taken to ensure proper footwork. Do not land with your feet wider than your proper front squat stance.

Training this movement has two significant benefits. It prepares the body to be tight when receiving the bar (add weight slowly!), and it drills proper footwork. In fact, you can return to this movement at any time in your training to correct footwork problems with the clean.

Online Video

<http://media.crossfit.com/cf-video/JournalCleanDrops.wmv>

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Clean drops

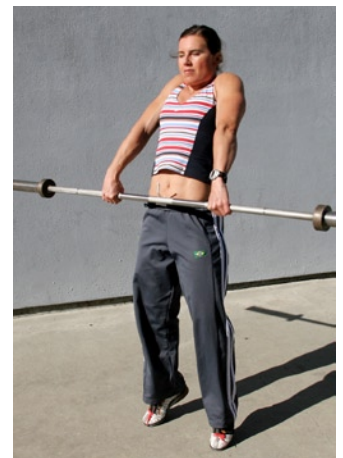
Hang squat cleans

You are now ready to perform a hang squat clean if you have trained the Burgener warm-up with the snatch. The simple instructions are to jump the barbell up from the hang position and then land in the bottom of the front squat. More thoroughly: starting in the high hang position, jump the barbell through the full range of motion and land in the full squat position with the bar racked properly on the shoulders with the elbows up. This incorporates the down and up with a full shrug and sufficient force to propel the barbell upward. Keep the bar close to the body by pulling the elbows high and outside, and then rapidly rotating them forward under the bar so you can receive it on the shoulders. The feet move quickly from the jumping position to the landing position, while the body moves rapidly from triple extension to the full squat position.

It is essential to keep the arms long (straight) throughout the pulls and the triple extension (the same as in the snatch) and to receive the bar in a full squat position. It is very tempting with light weight to pull the bar up with the arms and catch it high in a partial squat. This should be resisted aggressively. Ironically, it is often beneficial when working with the dowel or empty bar to think about keeping the bar low while you pull yourself under the bar into the bottom of the front squat. We have seen too many athletes who train power cleans extensively in the beginning of their development unable to transition to squat cleans even as the weight gets heavier. With proper mechanics, a well trained-athlete can squat clean substantially more than they can power clean. Unfortunately, many athletes who train power cleans primarily or who pull early with their arms find

they can power clean more than they can squat clean. If they can perform a full front squat, the cause of this is only a mental block to receiving the weight in a full squat position, and the solution is only to perform lots of repetitions of squat cleans at lighter weight. It is far better to learn properly from the outset than to have to start over later.

Once the high-hang squat clean is proficient, you can move down to mid thighs and below the knees in the same sequence as described in last month's issue for the snatch. By the time you reach the end of that sequence, you will be performing a full squat clean. As with the snatch, we have not seen great success rushing to perform full cleans (starting at the ground) before the hang clean is proficient.



Extension

Online Video

<http://media.crossfit.com/cf-video/JournalHangSquatClean.wmv>

<http://media.crossfit.com/cf-video/JournalHangSquatClean.mov>

Hang squat cleans

Online Video

<http://media.crossfit.com/cf-video/JournalFullSquatClean.wmv>

<http://media.crossfit.com/cf-video/JournalFullSquatClean.mov>

Full squat cleans

These movements make an outstanding warm-up when performed with a dowel. Weight should be increased very slowly and only as long as the movements remain proper. It is a fool's game to race to max loads. Moderate loads can mask technical errors for a while, but the more you train with poor technique, the harder it will be to correct later. When it comes to training progressions for the Olympic lifts, the tortoise always beats the hare.

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Body Shots

Becca Borawski

While kicks to an opponent's head and one-punch knockouts might make for great highlight reels, less-dramatic-looking punches to the body can drop an opponent with stunning pain. A memorable example of this in boxing is the 2004 Bernard Hopkins vs. Oscar de la Hoya match. Nine rounds into the fight, Hopkins landed a devastating blow to de la Hoya's side that dropped him and left him pounding on the canvas, unable to stand.

In last month's article on the left hook, I talked about the three distances between opponents—long, middle, and tight. There are also multiple levels from which a fighter can throw strikes. In boxing, a fighter can work the head and body. In kickboxing or Mixed Martial Arts, a fighter can target the head, body, and legs.

In this month's article, part three of a four-part series on striking, we'll look at the middle level of striking—to the body. Again this month, boxer and kickboxer Bridgett "Baby Doll" Riley demonstrates the moves in the photographs.

In Bridgett's experience, there are times when it seems you can throw a number of strikes to the head with no apparent effect, but when you start landing shots on your opponent's body, they begin to weaken. Once the core has been shaken, the rest of the body weakens, and the pain can also provide distraction that you can capitalize on.

The liver shot

The left hook to the body, also known as the infamous "liver shot" is one of the sweet spots a striker is looking for. Landing a blow to the opponent's liver, usually invoking a pause from the opponent and then a sudden doubling over or drop to the canvas. The effects of the liver shot can sometimes be felt for days following the bout.

The basic mechanics of the liver shot are the same as the left hook, but you are dropping level to land the shot on the body instead of the head. You accomplish this not by leaning over but by stepping into the punch and dropping your body down while keeping your torso erect. (For a more detailed description of the left hook, see last month's journal [issue 55].)

To execute a liver shot, begin in your fighting stance, and then transfer weight onto your front foot, bending your knee, and pivoting your left heel outward. Your hip will follow the rotation of your knee in toward the target. As your hip turns inward, your upper body and shoulder follow as well, putting your entire body behind the shot as your fist lands.

Land the strike with your thumb pointed vertically. The punch is thrown with a slight upward angle to dig up under the rib and into the liver. Keep your chin tucked down and your right hand



up at your face. Protect yourself at all times, even when executing offensive movements, and especially when fighting at a tight distance where the opponent will be looking to counter.

One of the prime opportunities for using body shots is when an opponent is trapped in the corner of the ring or up against the ropes. This minimizes their ability to maneuver and escape.

A good setup for the liver shot involves the jab (see *CFJ* issue 54). The jab can be used as a blinding technique. By throwing the jab in the face of the opponent and then slipping to the left, you place yourself in the perfect position to throw a liver shot.

The liver shot can also be used effectively in combination with a left hook to the head. Opponents frequently expect left-right combos and can be caught off guard when multiple strikes come from the same direction. Doubling up a left hook to the head and then the body, or vice versa, can be a winning combination.

Body Shots

...continued

Right uppercut to the body

Another great strike is the right uppercut to the body. As with the liver shot, the key is to get inside on the opponent and deliver the punch to the midsection without leaning over to do so.

Like the right cross, the power for the right uppercut is coming from the right foot. First, the right heel pivots outward, causing the right knee to turn inward and the hip to pivot and turn over. This propels the right shoulder, and therefore the right arm and fist, forward. Your whole body should be behind the punch to lend it the most power and explosiveness possible. "Sitting down" into your body shots will make them much more dangerous.

Remember that you are starting from the neutral fighting stance, and then pivoting, putting your hip into the shot. Your stance should look like that in Photo 6, and look like that in the next [Photo 7] when you land the right uppercut.

Bridgett also likes to turn her fist slightly as she lands this strike. [Photo 8] This really drills the punch into the opponent's body. As always, she is keeping her other hand up at her face and her chin tucked into her shoulder.

The key to finding success with body shots is a lot of practice (to hone down the perfect balance and leverage. Working with a trainer holding a pad, and learning to slip her opponent's strikes and throw body shots as counters is one way that Bridgett gets her practice in.



[Bridgett "Baby Doll" Riley](#) consulted on this article and is the demo model in the photographs. Bridgett is a former world champion boxer and a five-time world champion kickboxer. She trains and works at the world-famous Wild Card Boxing Gym in Hollywood, California, and also works as a stuntwoman and actress.

To see Bridgett in action, watch a clip online from her [World Kickboxing Association championship fight](#)



Becca Borawski, CSCS, teaches and trains at [Petranek Fitness/CrossFit Los Angeles](#) in Santa Monica. She has a master's degree in film from the University of Southern California and a background in martial arts training. She has blended these skills to produce DVDs and build websites for professional fighters. Her main job is as the music editor on the TV show *Scrubs*. She currently trains Brazilian Jiu-Jitsu with Rey Diogo, a Carlson Gracie affiliate.

You can see Bridgett throwing left hook combos to the head and body in the clip from her grueling fight with Shirley Prescott:

For examples of successful body shots in Mixed Martial Arts see:

Bas Rutten vs. Jason Diluvia (*Pancreas Truth* – 6)
 Scott Smith vs. Pete Sell (*Ultimate Fighter 4 Finale*)

Online Video **Bridgett vs Shirley Prescott**
http://babydollriley.net/video/bridgett_riley_shirley_prescott.mpeg

Rest and Recovery in Interval-Based Exercise

Tony Leyland

Whenever the Workout of the Day on CrossFit.com requires rest periods of unspecified duration between exercise bouts, there are always many questions about it on the comments page. This is understandable, as rest and recovery within a workout can be quite a complex issue, and the rest period should depend on the activity you are doing and the goal of the workout.

As many of you are aware, there are three systems that a human can draw on to produce the energy required to do physical work. These are the phosphagen, glycolytic, and oxidative systems (these are discussed in terms of sustaining maximum efforts in issue 10 of the *CrossFit Journal*).

A muscle must produce a chemical compound called ATP to fuel contraction. There is a very small amount of ATP already in the muscle, but the rest must be synthesized from other fuels in the body—creatine phosphate (CP) stores, glucose, fat, or protein. The chemical processes that produce the ATP from these different fuels are different, and some also require oxygen to be available while others don't.

The first of the three energy pathways—the phosphagen system—fuels the highest power output (rate of ATP production) but has only limited fuel available (small stores of ATP and CP in the muscle). The table below is quite technical, using moles of ATP per minute as the measure of power and moles of ATP as the capacity. But “moles of ATP” is simply a unit measure of the amount of energy available to do work. How much of this energy you can use per minute is one way to measure power (mathematically, power is the amount work done divided by the time it takes to do it). The important thing to see in this table is that the phosphagen system can produce nearly four times the power output of the oxidative system. Also note that the capacity of the phosphagen system is very limited, in that it can provide peak power for only approximately 11.5 seconds. Similarly, if you work at peak glycolytic power output rates, you'll be able to sustain that power level for only 45 seconds to a minute.

Energy system	Power	Capacity
	Moles of ATP per minute	Total moles of ATP available
ATP-PC (phosphagen)	3.6	0.7
Lactic acid (glycolytic)	1.6	1.2
Aerobic	1.0	90.0

Table 1. Estimated maximal power output and capacity of the three energy systems. (Data from Foss and Keteyian 1998, p. 35.)

It all seems very neat and progressive as described here, but, in actuality, we do not use up one system and then switch to another. During exercise we tend to use all three (except during low-power-output efforts that can be sustained for 60 minutes or more, which use the oxidative system pretty much exclusively). The table below shows the approximate percentage contribution of each of the systems for maximal power outputs of different time durations. For example, if I work at a power output that I can sustain for only 30 seconds before reaching fatigue (and hence a reduction in power output), approximately 65 percent of the energy would be supplied by the glycolytic system over those 30 seconds.

Duration of power output	% Phosphagen	% Glycolytic	% Oxidative
5 seconds	85	10	5
10 seconds	50	35	15
30 seconds	15	65	20
60 seconds	8	62	30
2 minutes	4	46	50
4 minutes	2	28	70
10 minutes	1	9	90
30 minutes	negligible	5	95
60 minutes	negligible	2	98
120 minutes	negligible	1	99

Table 2. Approximate percentage contribution of the three energy systems during maximal power outputs of varying durations.

Table adapted from McArdle, Katch, & Katch 1996; Williams & Wilkins 1996, p. 129; and National Coaching Certificate Program 1990.

I will often ask my students on an exam, “If you got up and walked across the room for 10 seconds, what energy system would you predominantly use?” The answer is the oxidative system, because the power output is so low when I walk that I could sustain that power output for hours and hours. But if I asked “If you sprinted all-out for 10 seconds, what energy system would you predominantly use?” the answer would be the phosphagen system. So although time is shown on the left side of the table above, you must realize that it is really power output that determines the energy systems used (and high power output—aka *intensity*—cannot be sustained over long periods).

Before we discuss rest periods I should also mention muscle fiber types. Numerous books have been written on this topic and there is some disagreement on the right way to classify muscle fibers.