

Starting Strength

Understanding the Master Cue

by

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On page 58 of the Blue Book, I make an argument for the use of the mid-foot position as a cue for the correction of form problems. While this approach is useful with heavy weights, it can be misused with light weights and when teaching the movement at first, because the mechanical argument is often misunderstood, and it can be misapplied by an inexperienced coach.

First, the basics. The middle of the foot is the *center of balance* (COB) when the feet are balanced within the frontal plane, as in a squat, press, or deadlift. The middle of the foot is obviously half-way between the toe of the shoe sole and the heel, and when you are “balanced” while standing your weight is distributed evenly across the sole of the shoe.

The body’s *center of mass* (COM) is a calculated average position of the mass distribution that depends on the configuration of the mass. If you are standing in normal anatomical position with your arms at your sides, it will be about 3 cm anterior to your sacrum, lower if your legs are long, higher if your torso is long. If you stand with your arms overhead, the calculation moves the COM up toward the mass of your arms. If you squat to below parallel, your calculated COM will be in the air between your thighs and below your chest. It’s a calculation, not a bodypart.

When we lift barbells, we add another variable to the COM calculation: the mass of the barbell. Since you move the bar with your body, we must consider the *combined center of mass* (CCOM) of the lifter/barbell system. The lighter the bar, the closer the CCOM is to the COM of the lifter; the heavier the bar, the closer the CCOM is to the loaded bar. If you squat to below parallel, the calculated CCOM will be in the air between your thighs and below your chest, but higher up, closer to the bar. If you weigh 200 and you’re squatting 800, the bar’s mass is very important to the CCOM calculation. It is the CCOM that interacts with the mid-foot COB in barbell training.

If the COB is the mid-foot, and the body’s COM is just anterior to your sacrum when standing up straight, a “balanced” position is one that positions the COM directly vertical to the middle of your foot. This position is the one which requires the least amount of force to maintain while standing up on both feet, due to the absence of extraneous moment forces on the system. Demonstrate this to yourself by standing up, leaning slightly forward, and noticing what happens at the floor: the weight of your body that was distributed across your entire foot is now centered on the ball of the foot, and your calf muscles are producing force to keep you from falling forward – force that was previously not required when you were “in balance.”

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When you squat down and stand back up, you either keep your COM in balance directly over the mid-foot, or you generate enough stabilizing force to compensate for the lack of balance. It's easier to stay in balance, and, in fact, learning this critical skill is part of training with barbells.

When we train the squat we use a loaded barbell, and this barbell *when heavy* (depending of course on how strong you are) moves the CCOM of the system up closer to the bar. This means that a heavy squat will be performed in balance with *the barbell* traveling in what will be close to a vertical path over the middle of your foot. If it deviates much at all from this position, a large moment force is created by the long vertical distance between the mid-foot COB and the load way up on the back, even if the angle and the moment arm are small.

The same vertical bar path mechanics over the mid-foot are observed with a heavy deadlift, with some deviation caused by the changing shin angle as the bar approaches the knee. Note also that the upper body at lockout is behind the bar, because the bar is resting on the front of the thighs, and this balances the CCOM over the mid-foot. But the bar in front of the shins and thighs makes a heavy deadlift fundamentally different than a squat. If the bar is to stay in balance over the mid-foot, the forward position of the shins and thighs are pretty much limited to that of the gravity vector: if the knees drift forward and push the bar forward of the COB, moment forces are created by this position that may exceed the ability of the lifter to compensate for, so at heavy weight a failure to keep the knees and shins back is fatal.

The squat is not restricted by the position of the bar, except that the CCOM of the system must be in balance too. The shins, thighs, and back have the freedom to travel pretty much anywhere they want to, since the bar is not in the way – you can front squat, high-bar squat, or squat correctly if you choose to do so. This is why the squat is difficult to coach, and why most people happily disregard our low-bar optimization model while still squatting the bar. And since most people do not squat heavy anyway, it really doesn't matter to them if the use of their muscle mass is optimized or not.

What about a warmup with the empty bar? Our hips-back low-bar model produces a more horizontal back angle than an uncoached squat, and *light warmup sets that show this back angle/hip position will also place the bar in front of the mid-foot COB*. This is just fine at light weight, because a lot of the body's mass is in the hips behind the feet, and light weights do not command strict adherence to efficiency.

Our purpose in a light warmup squat is to practice the hip and back position we will use in a work set, not to demonstrate the terminal balanced position at 1RM. *Do not expect a 45-pound warmup to behave like a heavy work set*, because it is a different physical system, and the light weight allows a modicum of disobedience to the laws of mechanics that would operate in a heavy squat, in deference to practicing the position that generates the most force under heavy weight. In fact, if you insist on the barbell/COB vertical alignment under an empty bar, you will be using a back angle or a knee position that is too vertical for the low-bar model of the squat. (This may be why we have so much trouble with back angles at the seminar.)

Low-bar squats done by a novice with light weights, a masters lifter with light weights, or any male lifter of average size using loads significantly lighter than about 225 will not behave as a heavy work set described in the book – the bar will be a lot to a little forward of the mid-foot because the



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barbell is not yet significantly heavier than the mass of the body, and we want to warm up the terminal balance position, just like the muscles, joints, and bones.

What about the press? Mechanics apply to the press as well, and the CCOM of the system is quite likely to remain closer to the COM of the lifter until you get pretty strong. With even a bodyweight press – relatively strong by modern standards – the CCOM is quite a distance below the bar at lockout. This means that you will see presses that tolerate quite a bit of deviation from the CCOM/COB vertical relationship that dominates a heavy squat or deadlift. At light weights, the CCOM/COB relationship is not as important as other aspects of the movement.

Consider that an efficient press must minimize the distance between the bar and the shoulder joint on the way up, because even at relatively light weights a long moment arm between shoulder and barbell can become very hard to operate. “Getting under the bar” as you drive it up keeps the moment arm short, but may result in the bar ending up behind the mid-foot COB at lockout for most of your light sets. A correctly finished press is shrugged into lockout, and this usually results in the right alignment. But even though the correct terminal relationship between bar/shoulder/mid-foot is vertical, it does not *have* to be until the load gets heavy, because a heavy press *for most people* does not command the same attention to the management of extraneous moment arms as a heavy squat or deadlift.

The upshot of this is that The Master Cue does not apply to every set in a workout, or perhaps even to any set in a workout. It is terribly useful in the right situation, which would be work sets for advanced novice, intermediate, and advanced lifters who are having trouble with bar path issues. It doesn't apply to warmups, novice and special population squats, most presses you'll see in the gym, and to teaching these movements for the first time. Develop other cues to address the problems you see on the platform and save The Master Cue for when it fits well, because our workspace is definitely not One-Size-Fits-All.



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