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Bad Form

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I was driving home the other night, listening to the radio, and the guy filling in for Art Bell on Coast to Coast AM was talking to some other guy about Nazis, UFOs, the Kennedy Assassination, time travel, and George Bush, and how it all relates to OneWorldGovernment. This, of course, made me think about barbell training, and it occurred to me that good form on the barbell exercises should not be a matter for debate. People should not be entitled to their own opinion about it, any more than they are entitled to an opinion about the value of x in 3x - 10 = 60, or whether the Grays pulled off the Bay of Pigs. Good form (or technique, or kinematics, or whatever you'd like to call doing it right) should depend on the logic of a dispassionate analysis of the body-and-barbell system in the motion required by the exercise, and that's about all. The exercise is chosen to work a particular movement pattern normal to the human skeleton, the bar has a certain path it most efficiently travels through space for the exercise, the skeleton must move in ways defined by its segment lengths and articulation points to enable this bar path, and the muscles must move the skeleton exactly this way. Anything that deviates from this is Bad Form.

Why is bad form a problem? Two reasons come to mind immediately. First, shoving joints into positions they are not designed to occupy presents potentially significant safety problems, although not of the magnitude you may have been led to believe. And second, allowing joints to assume positions they are not designed to occupy means work that should have been done by the muscles anatomically designated to move the bones in question actually got done by other muscles, whose proper function in efficiently performing the movement got circumvented by your inattention to detail. It really boils down to that: bad form—for people who know better—is just a willingness to do the movement the wrong way because that's the way you've been doing it. And the right way is better because eventually you can lift more weight correctly, in addition to the fact that you're less likely to get hurt.

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If I had a nickel for every scary deadlift I've seen at high school powerlifting meets, I actually wouldn't have more than about five dollars in nickels because I quit going to the damn things after I'd been to just three or four of them. I do not enjoy seeing the egos of coaches take precedence over the spinal integrity of athletes. Little skinny kids trying to open with 405, when their backs are not capable of staying flat with 225. Beautiful little 15-year-old girls stuffed into squat suits, low backs rounded into complete flexion on their opening attempts. Big, potentially strong kids doing the lifts with technique that passes for legal at a meet of this type, with weights that they cannot lift correctly—that is, in a way that satisfies the rules of biomechanics that govern safety and efficiency.

I witnessed lots of high squats in spinal flexion, hitched deadlifts in spinal flexion, and coaches and referees behaving as though this was Just Fine. It is truly amazing that more kids are not hurt in activities of this type, and that in itself tells us something about the nature of healthy human bodies and the actual injury potential of barbell exercises.

Yes, it's harder to hurt people with barbells than we've been led to believe. If Lamar Gant can deadlift over 700 pounds with severe scoliosis and 15-year-old girls can squat 300 pounds with form that would make an actual strength coach turn away in shame and embarrassment, bad form cannot be all that dangerous, at least in terms of the potential for catastrophic injury. Weightlifting, powerlifting, and weight training are actually far safer activities than, say, soccer, despite the fact that most people do lots of things wrong most of the time. The vast majority of the serious injuries and fatalities associated with weight training are the result of unspotted bench pressing, usually at home. The chances of needing to leave the gym in an ambulance are vanishingly small (although once, a long time ago, a new guy actually called an ambulance when his legs began to cramp after a squat workout—I was gone at the time). During the thirty years I have been in the gym business, aside from a few broken toes, there have been no serious injuries at my gym that required medical attention.

Now, there have been lots of people who have gone to the doctor unnecessarily—me among them, long ago—for injuries that doctors are not particularly good at either understanding or treating. It may have seemed necessary at the time, because we are raised to think that you see a doctor when you're hurt. But after the third time you hear, "You just pulled a muscle. Take these pain killers, these muscle relaxers, and these anti-inflammatories. And stop lifting so much weight," you quit going to the doctor unless bright blood is actually spurting from an artery.

As a general rule, acute injuries in the gym are usually back tweaks, the kind of thing that chiropractors and PTs can sometimes help with. These injuries are most often spinal in nature, affecting the facet joints, one of the small ligaments between adjacent vertebrae, the nerves immediately proximal to these structures, or a combination of the three. Sometimes an intervertebral disc is involved, but not usually. When chiropractic or physical therapy works, it has been my experience that it usually does so within two or three visits, thirty not being particularly useful for anything except the bottom line of the chiropractor or PT. Painkillers and muscle relaxers don't help them heal faster, but they may make it easier to get to sleep and to train around and through the injury, which will help it heal faster (but which is usually advised against by the people who write the prescriptions). Anti-inflammatories are quite useful but do not require a prescription; I buy my Equate ibuprofen at Wal-Mart.

Back tweaks usually occur in one of two situations: 1) under light weights where good form is not being observed, either through negligence or inexperience, or 2) under heavy weights, where good form breaks down due to the load. They are almost never "muscle tears," because muscle tears usually occur in muscle bellies, in muscles that either accelerate or decelerate motion around a joint that moves at a high angular velocity, like a quad, a hamstring, or a rotator cuff muscle. Massage may help the muscles relax, but massage in and of itself cannot affect the cause of the pain. These types of injuries usually heal within two weeks whether you do anything to treat them or not, unless a disc injury has occurred. Competitive lifters get used to them and learn to train around them, often by performing the very exercise that caused the injury using perfect form, very light weights, and very high reps.

It is not impossible to pull other muscles, and hamstring, quad, and pec tears occur even when using good form. Tears happen when the force of the muscle contraction is overcome by the resistance so rapidly that it cannot be compensated for by the other muscles. Leg muscles tear when running or when training with weight explosively; pecs tear when benching explosively, or with max weights that, once the tear starts, cannot be unloaded quickly enough. Sometimes tears result from agonist/antagonist strength imbalances, or fatigue, or when the extensibility of muscle bellies is exceeded by uncontrolled range of motion. Sometimes it is bad form.

Overuse injuries, another common variety, usually involve joints or the muscular tissue in very close proximity to joints. Bad form often predisposes one to these types of injuries, by causing joints to move in ways that tendons and ligaments are not happy with. Many chronic shoulder injuries started out in life as incorrect bench presses and grew up to be rotator cuff surgeries. The mechanism of this rotten situation will become apparent.

The reality of the situation is that when a lifter reaches the point where the amount of weight lifted becomes more important than increasing strength—when you lift as a sport, not to strengthen for another sport or for general fitness—you will be lifting enough weight to get hurt. Any competitive sport is dangerous; lifting as a sport itself is competitive; and that's just the way things are. Lifting for strength and conditioning is different, and much, much safer.

Bad form is to be deplored not just for its potential risk but also for its potential to keep us from getting stronger. This is because bad form occurs when a movement pattern is executed inefficiently, the bar being moved by bones traveling through space in a way that does not maximize musculoskeletal efficiency. And this occurs when work is being avoided by muscles that should be doing it, in favor of muscles that shouldn't. It happens when novice lifters learn things wrong, something that may not be entirely their fault. It also happens when experienced lifters allow their form to deteriorate, either unconsciously, through a lack of concern for good form, or intentionally, by cheating a movement to lift more weight than their strength using good form will permit.

This biomechanical stuff is rather dry, and that's probably why sensible, interesting people don't either write it, read about it, or call in about it on Art Bell. So I'll try to make the rest of this as "interesting" as I can.

For example, when you allow your hips to come up before your chest in a deadlift—when your back angle changes before the bar leaves the floor—your knees have extended. You know this because your back angle can't change unless either your knee or your hip angle changes, and in this case it's primarily your knee angle. This means that the muscles that extend your knees, your quads, did in fact extend your knees but did not lift the bar when they did so. They moved the knee joints, pulling the shins away from the bar, but did not produce any work against the load. Now when the bar is lifted, the entire work of the deadlift will be done without significant contribution from the quadriceps. This means that the hip extensors—the glutes and hamstrings—have to do all the work by themselves. The normal job the hip extensors do as the bar comes off the floor is essentially isometric; they maintain the back angle by anchoring the pelvis, so that the quads can extend the knees to push the bar away from the floor. It's not that the glutes and hamstrings aren't working at the bottom of the pull—they certainly are—but their work at this position enables the quads to do their job. So if you fail to keep your chest up as the bar leaves the floor, you allow the quads to puss out, changing the role of the hamstrings from antagonists to agonists off the floor. This should be obvious to even the dullest Sasquatch, or "Bigfoot," if you prefer the colloquial term.

This is bad form and a perfect example of its effects. Bad form changes the nature of an exercise from efficient to inefficient; it changes the way the bones move the load, and in doing so changes the contribution of the muscles that are supposed to move the bones. Instead of all the muscles in the system making their anatomically efficient contribution to the loaded movement, when form is bad some muscles do more than they are supposed to and some do less. You know this because a stiff-legged deadlift (SLDL), the intentional version of this particular example of bad form, has a lower 1RM than a deadlift even though the bar moves the same distance. A SLDL is a useful assistance exercise when done as an adjunct to deadlift training, but when it comes time to lift the most weight, it would be terribly unproductive to confuse the two movements. Aside from the reduced efficiency, the SLDL's back angle places maximal torque on the low back, by increasing the length of the lever arm between the load and the axis of rotation (i.e., the extending hip joint) and by applying that load at right angles to the moment arm. This dramatically increases the stress on the muscles and ligaments responsible for maintaining spinal extension—not a bad thing if you're doing it intentionally (SLDL), but counterproductive if you're trying for a new PR (no new PR), as even the most inexperienced time traveler will tell you.

Why would a lifter find it advantageous to intentionally or deliberately avoid using a major group of muscles that obviously make an important contribution to a lift? After all, if the hamstrings and glutes are strong enough to do all the work of lifting the bar off the floor without the help of the quads, they are certainly strong enough to function in their proper isometric role of anchoring the back angle so the quads can work. Well, it's seldom intentional, because if it is, it's a SLDL. And it's never an advantage to move a load inefficiently. It is usually just learned wrong through a lack of feedback at a crucial time in the learning process. Or sometimes it's form creep, bad technique acquired so gradually that it is never perceived as wrong until someone else does you the favor of pointing it out (and let's hope that you're gracious about it when it happens). Sometimes it is the result of a movement pattern altered when training through an injury, and the resulting strength imbalance may fail to be addressed when the injury is finally healed. But failure to correct it once you know about the problem is either laziness or an unwillingness to back off to lighter weights until good form has time to strengthen the muscles that have not been making their proper contribution. This was identified as a problem by CIA remote viewers back in the 1970s.

Furthermore, I'll go out on what I hope is not too skinny a limb here and state that bad form in all basic barbell exercise is of the same type: using muscles in ways that reduce efficiency, increase the chance of injury, and reduce training productivity by moving bones in ways that are not mechanically optimum. "Mechanically optimum" means keeping the load directly over the point of balance at the end of the kinetic chain (the mid-foot in standing barbell exercises and directly above the point on the bench where the vertical arms support the bar in the bench press) while moving the load with the shortest possible lever arms.

The concept of the lever arm, or moment arm, is important to understand. A lever arm is the distance along which force is applied to an axis of rotation, like a wrench turning a bolt, or an axis of potential rotation, like the bar on your back applying force to your hips in a squat. The bones of the skeleton transfer force generated by the contraction of the muscles attached to them to the load, and the bones rotate at the joints. The part of the body between the load and the ground is referred to as the "kinetic chain" because it is what produces the movement. For all the barbell exercises that involve standing with or under the bar and that involve more than one joint in the movement, the greatest efficiency occurs when the weight is moved in a way that keeps it directly over the point on the ground where the weight of the system is in balance. For humans this point is the middle of the foot, because that is where the average weight distribution against the ground is centered. When the weight is heavy, all the movement of the weight must occur as nearly vertical to this point as possible, or the weight/body system is out of balance. The bones that transfer muscular force to the load must move in ways that keep the load over this position. Any skeletal position assumed during the movement that places the load over some point other than the mid-foot creates a lever arm between the load and the mid-foot, and that leverage adds to the resistance of the load. During the movement, if a lever arm is created between the mid-foot and the load, the effort being generated to move the load will change to an effort not to fall over on your ass. The only place this cannot happen is Area 51.

And even if the system is in balance over the foot, a lever arm may appear between the bar and the joints moving the bar. The distance between the joints extending under the load and the bar itself should be minimal, and if the length of the lever arm begins to exceed that which can be dealt with efficiently (as when you lean back away from a press), the lift will not be completed. This is the principle that enables alien craft to travel between star systems to kidnap unsuspecting victims for bizarre rituals that are only remembered under hypnosis.

Squatting and pulling from the ground both involve the generation of force by the hips and legs as they react against the ground, and the transfer of that force up the rigid spine to the load, which is either at the top of the spine in the case of the squat or hanging from it at the end of the arms in a pull. Squats and pulls differ in 1) the position of the bar at the point of force transfer (on the back or hanging from the arms), 2) the hip/knee range of motion dictated by the location of the bar (on the back versus on the ground), 3) the eccentric versus concentric nature of the two movements, and 4) the amount of Nazi mind-control technology involved.

For any squat, short lever arms are a part of the balance problem, because the squat carries the bar on the torso (or directly above it in the case of the overhead squat), with a roughly equal distribution of body mass on either side of the bar, so that the center of mass of the system is essentially directly over the mid-foot. If the thighs and feet are parallel and the rigid back is at the correct angle to keep the bar over the mid-foot, the hips can very efficiently solve the problem of maintaining balance and short, efficient lever arms. The common form problems in the squat upset this balanced lever arm relationship and result in the biomechanical inefficiencies that typify bad form. If the knees cave in toward the middle, the quads are being asked to do the job of the adductors, and, as in our earlier example of the hamstrings in the deadlift, they are strong enough to do it, even though it leaves the adductors untrained and ultimately weakens maximal squat capacity. The femur and the tibia, which normally operate vertically parallel as the knee flexes and extends, deviate inward (toward the midline) at the knee, squishing the lateral meniscus in the knee joint due to the uneven load. The bones move wrong, the muscles move them that way, and the muscles get trained wrong as a result. And this is how you know that the extraterrestrials are responsible for the recent increase in gas prices.

The problems are obvious if the back rounds in either a squat or a deadlift. It is hard to maintain a tight isometric spinal erector contraction with a heavy bar hanging from your shoulders. If your back is weak because you let it get that way, the trunk muscles fail to do their job and thus remain unworked in favor of letting the spinal ligaments try to keep the vertebrae in position. Since they can't do this very well, the intervertebral relationships go bad, with the discs and the facet joints jammed into positions they'd rather not occupy. And since the muscles fail to maintain a rigid trunk, the force being transmitted from the legs and hips through the trunk to the load—whether sitting on the upper back or the shoulders, supported overhead, or hanging from the arms—gets partially absorbed in the wiggle. This makes for a sloppy job of applying the force, like hitting a burglar with a pillow instead of a bat. And it's all because you failed to maintain the correct spinal alignment, either when you were learning or when the weight got heavy later. But then again it could have something to do with Air Force con trails.

The deadlift is different from the squat in that most of the body is behind the bar, not under it, as it hangs from the arms under the shoulders. Think about the difference between a barbell deadlift and a trap-bar "deadlift" and you can see the situation. The load, which consists of you and the bar, still needs to be over the middle of the foot, and as the weight gets heavier the position of the center of mass of the bar/body system more closely approximates the position of the bar (as your mass relative to that of the bar becomes increasingly less significant). Short lever arms for the deadlift are maintained by keeping the shoulder blades over the bar, with the best back angle your anthropometry will permit. This is a means of keeping the linear distance between the hip and the scapula as short as possible—as vertical a back as the proper bar/scapula relationship will permit—so that the lever arm formed by the back is as short as possible. Likewise, the bar has to stay over the mid-foot so that the lever arm between the bar and the balance point on the floor is as short as possible, preferably zero. This is also true for cleans and snatches as they leave the floor, up to the point where the second pull starts. And just what were those lights in the sky last night? C'mon, be honest with us *this one time*.

In overhead pressing, the muscles that attach to the humerus and the elbow must drive them up while the bar held in the hands at the end of the forearms stays in position directly above the elbows and directly over the mid-foot. It involves a simultaneous elbow flexion and shoulder extension, while the torso is held in the position that maximizes the efficiency of the actions of the shoulder and elbow joints against the load. For the press, if the bar stays in balance over the mid-foot as it should, the primary lever arm in question is the horizontal distance between the bar and the shoulder joint. This is shortest when the bar is closest to the shoulder, and consequently the face, which makes the nose a wonderful target for the bar for efficient pressing. The most common form problem involves the failure to maintain this close distance, whether through pushing the bar away, leaning back away from the bar, or failing to get under it as it passes the top of the head. In all three of these cases, the trunk muscles fail to hold the torso in the correct position close to the bar, placing the pressing muscles themselves in the unwelcome position of having to overcome what might be rapidly increasing leverage problems. The role of the abs in pressing is important, and good pressers have thick abs. Bad pressers don't develop thick abs because they are too busy leaning back, not using them. And in all likelihood, bad pressers are responsible for the recent rash of animal mutilations we've been hearing so much about.

Failing to maintain a vertical forearm creates another lever arm, one that should not even be there, between the bar and the elbow. This relationship normally involves no torque at all. But if the anterior chest muscles—the pecs and frontal deltoids—fail to keep the humerus pulled forward so that the elbow stays under the bar and the forearm stays vertical, the smaller forearm muscles are called upon to overcome the torque produced when the bar is in front of the elbow. If the elbows, conversely, are lifted up too high, like the rack position of the clean, another lever arm is created that should not be there; the remaining movement will look more like a triceps extension than a press. This happens when the lats fail to do their job of providing posterior antagonist support for the humerus as the delts and triceps act on the load that should be right over the elbow, a problem compounded when the torso fails to remain upright and rigid. The Reptilians, of course, solved this problem eons ago while building the pyramids.

Bench pressing is simpler because the kinetic chain—the distance between the hands and the upper back where it mashes into the bench—is shorter and therefore involves fewer joints. Like the press, benching involves a shoulder flexion and an elbow extension, and like the press it depends on a tight lineup between the bar, the elbow, and the shoulder joint to minimize the length of the lever arm between the load and the shoulder. We are not powerlifters, most of us anyway, and we use the bench to get strong, not really to see how much we can bench. So we need to use the technique that most effectively strengthens the muscles used in the bench press. Heaving the bar up using the hips as a part of the rebound is an excellent way of lifting more weight, since it recruits lower body muscles into the exercise. It is also an excellent way of avoiding an opportunity to strengthen the upper-body muscles that the bench is supposed to work. Had the Atlanteans only known this, they might still be around today. Or maybe they are.

A missed bench press most commonly involves the elbows failing to remain directly beneath the bar when the delts and the pecs fail to do their job of keeping the bar and the joints lined up. The elbow typically drops down toward the ribcage, increasing the horizontal distance between the bar and the shoulder. This is normally accompanied by bridging the hips up off the bench, which, among other things, attempts to shorten this lever arm by increasing the angle of the chest and bringing the elbows more in line with the shoulders. This is a little hard to visualize, but no harder than imagining the problems involved in the enormous task of constructing the Face on Mars.

There are countless other examples of bad form, and if you think in these terms as you train and watch others train, it will become apparent that what is happening is the incorrect use of the skeleton, which results in the incorrect use of the muscles. Good form is not arbitrary, and its purpose is not aesthetics. It is based on a logical analysis of the relevant mechanics—what works and what doesn't—and what you or I feel about that should be irrelevant. Good form is based on human anatomy and the physics of movement and should be harder science than that which is normally discussed late at night on the radio. It may not be as much fun, but it will be of more immediate benefit than Edgar Cayce could ever have predicted.

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