Young athletes need to get a head start with the BFS Readiness Program.

BFS POSITION PAPER

Strength Training for Young Athletes

The risks and benefits of having preadolescent and adolescent athletes train with weights

When someone starts lifting weights seriously, we often say that this individual has been "bitten by the iron bug." Just a few decades ago those who belonged to this group were primarily football players, bodybuilders and, of course, weightlifters and powerlifters. Now just about everyone, male and female, is infected with the iron bug. Basketball players lift weights to improve their vertical jump, sports medicine providers prescribe lifting to rehabilitate injuries, and even senior citizens hit the iron to improve their quality of life.

There are many ways to get strong. To this day our military forces still rely on strenuous calisthenics, such as push-ups and pulls-ups, to prepare our soldiers for duty. And there is no question that hard physical labor, such as working in construction or doing chores on a farm, can certainly increase strength and even add muscle mass. But decades of research have proven that weight training is, hands down, the single most effective way to build strength. With weight training, whether it is with free weights or machines, the muscles can be targeted with specific exercises and the resistance can be precisely controlled to achieve an optimal training effect.

In the field of athletic fitness,

coaches know that weight training is the best way to improve an athlete's power, speed, flexibility, body composition and muscular endurance. Major colleges and professional sports often spend millions of dollars on weightrooms, and it's rare that any high school in this country does not have some type of facility for resistance training.

Further, exercise scientists have conducted clinical studies that prove that any cardiovascular health benefits that occur with aerobic training can also be achieved with weight training. There also is research indicating that one of the most effective long-term solutions for preventing osteoporosis in women is to have them participate in activities that place a high level of stress on the bones during childhood and adolescence.[1] So it's not a matter of *if* weight training is an effective way to achieve physical and athletic fitness but *when* it is appropriate to start pumping iron.

The Medical View

One article that is often cited in support of the opinion that weight training is not safe for young people is the position paper on strength training published by the American Academy of Pediatrics.[2] That article is not technically a research paper but is the opinion of a group of individuals – just as this BFS position paper is based upon the opinions of BFS coaches throughout the 33-year history of this organization.

After presenting their summaries of the research, the authors of the AAP paper concluded, "Preadolescents and adolescents should avoid power lifting, body building, and maximal lifts until they reach physical and skeletal maturity." Let's take a closer look at the consequences of following such advice.

Although it depends upon the individual, "full skeletal maturity" may not be achieved until the age of 18 in males, and perhaps slightly younger for females.[3] The AAP opinion thus suggests that most male American football players should not lift heavy weights to prepare them for a strenuous contact sport such as football until they have graduated from high school. As for female gymnasts and figure skaters, who often retire in their early teens due to the expense of competing in these sports, they are

Photo: Navy SID

Bobby Doyle, who plays football for the Naval Academy, is the son of BFS clinician Bob Doyle. At Chardon High School in Chardon, Ohio, Bobby earned three letters in track and football. Doyle's earlier BFS training had given him a head start in his college career. His numbers during high school include the following: 300-pound clean, 455 parallel squat, 500 x 10 box squat, and 34.2 seconds in the Dot Drill.

in effect being told not to lift weights to improve their athletic performance until several years after they have quit the sport. Is this wise? We don't think so.

Suggesting that a high school athlete can play football but should not be allowed to physically prepare himself for the stresses that occur in the game simply does not make sense. Although school districts try to maintain an equal standard of competition by having athletes compete against schools of approximately the same number of students, this is not enough to ensure that a reasonable level of safety will result between opposing players. Having a 6-foot, 225-pound lineman who power cleans 250 pounds, bench presses 300 and squats 400 (lifts that are common in many high school football programs) face off against an untrained, 175-pound lineman of the same height with no weight training experience cannot end well. Likewise, is it wise to expose young gymnasts and figure skaters to the extreme stresses in these sports without strengthening their muscles, tendons and ligaments with a progressive resistance training program?

Photo: Reg Bradford

Having young women lift weights is one of the most effective ways of preventing osteoporosis in later years. Shown is Kelsey Weisheit, a former figure skater who could clean 15 pounds over her bodyweight when she was 12 years old.

Besides the lack of logic in this recommendation, the conclusions by the AAP do not appear to coincide with the research they cite in their article, as evidenced by these two comments: "Appropriate strength-training programs have no apparent adverse effect on linear growth, growth plates, or the cardiovascular system…." and "…strength training in youth may stimulate bone mineralization and have a positive effect on bone density." All we can assume is that this organization does not want to incur any liability risk by promoting weight training. After all, it would be difficult to prove in a court of law that a football player was injured because he was not physically ready to play a game, as opposed to establishing that the same athlete had pulled a muscle in the weightroom from lifting a weight improperly.

Can Weight Training Stunt a Child's Growth?

One of the major concerns about weight training for young athletes is about its potential to damage the epiphysial (growth) plates, resulting in a failure to achieve normal height.

Addressing this subject in many of his publications and lectures was the late Mel Siff, Ph.D., an exercise scientist whose doctoral thesis examines the biomechanics of soft tissues. "It has never been shown scientifically or clinically that the periodic imposition of large forces by weight training on the growing body causes damage to the epiphysial plates," says Siff in his book *Facts and Fallacies of Fitness*. "It is extremely misleading to focus on the alleged risks of weight training on children when biomechanical research shows that simple daily activities such as running, jumping, striking or catching can impose far greater forces on the musculoskeletal system than very heavy weight training."[4]

To illustrate his point, Siff compared the stress of squatting with that of running. "Suppose that one child runs a few hundred meters a day in some sporting or recreational activities. This can easily involve several thousand foot strikes in which the reaction force imposed on the body can easily exceed 4 times bodyweight with every stride. Now let another child do a typical average weight training session with 3-5 sets of squats (say, with 10 reps, 8, 6 and 4 reps), with bodyweight or more for the last set. That bodyweight is divided between the two legs, so that, even taking acceleration into account, the loading per leg is bodyweight or a little more, while the spine is subjected to the full load on the bar. In other words, the legs and spine in controlled squatting are exposed to significantly less force than in running and jumping. Normally, exercises such as squatting will be done no more than twice a week for a total of about 60 repetitions, while the running child will run every day and subject the body to those many thousands of impulsive foot strikes.

"It does not require much scientific

knowledge or computational genius to see that the cumulative loading imposed by simple running activities on the lower extremities and the spine is far greater than the cumulative load of two or three times a week of weight training. Does this now mean that we are justified in recommending that children not be allowed to run, jump, throw or catch because biomechanical research definitely shows that such activities can produce very large forces on many parts of the growing body?"

Siff also notes that bone density scans have proven that youngsters who do competitive weightlifting (i.e., the snatch and the clean and jerk) have higher bone densities than children who do not use weights, and that clinical research has not shown any correlation between weight training and epiphysial damage. Further, an extensive Russian study on young athletes, published in a book entitled *School of Height,* concluded that heavy lifting tends to stimulate bone growth in young athletes rather than inhibit it.[5]

As with muscles, bones become stronger in response to stress, and the activities involving the highest levels of stress can encourage the formation of stronger bones. In one study involving 64 elite athletes in several sports (including swimmers, soccer players, runners and throwers), the athletes with the highest bone density in the femurs (upper leg bone) were weightlifters.[6] Further, bones are better designed for resisting compressive loads, such as those that occur in the sport of weightlifting, as opposed to resisting the shear forces that are more common in sports such as soccer.[7]

One possible reason for the fear that weight training could stunt growth is that many of the participants in weightlifting are not very tall, and may even appear shorter than they are because they possess more muscle mass than many other athletes. But consider that in gymnastics, the average height of elite athletes has steadily declined in the past several Olympics because shorter athletes tend to be more successful in this sport. So saying that weightlifting makes you shorter because many elite weightlifters are short would be like saying that basketball makes you taller because most professional basketball players are tall!

Is Weight Training Dangerous?

Risk of injury is another area of concern for some coaches and parents. In this regard, it's instructive to look at the many studies that have measured the rate of injuries associated with weight training compared to other sports. For example, a study published in the November/December 2001 issue of the *Journal of the American Academy of Orthopaedic Surgeons* cited research showing that in children of ages 5 to 14 years, the number of injuries from bicycling was almost 400 percent greater than from weightlifting![8] Also, in a review paper on resistance training for prepubescent and adolescents published this year in *Strength and Conditioning Coach* (Vol. 9, No. 3), author Mark Shillington reported in a screening of sports-related injuries in school-age children that resistance training was the nominated cause of 0.7 percent (or 1,576 injuries) compared to 19 percent for football and 15 percent for baseball.[9] Further, the primary cause of injury in the studies we've examined is improper technique.

In the United Kingdom, a study by Brian P. Hamill showed that of the 22 sports surveyed, soccer had the highest injury rate, with 6.2 injuries per 100 hours of exposures (6.2 percent), followed by rugby with 1.92 injuries per 100 hours of exposure (1.92 percent). The lowest injury rate was in the sport of competitive weightlifting, with a .0017 rate (0.17 percent). In discussing competitive weightlifting in their country, the authors noted the following: "Britain's Schoolboy Championship has been staged annually for at least 18 years and has involved some 54,600 competition lifts (maximal or nearly so) and at least 54,600 lighter but still heavy warm-up lifts. In this period one boy suffered a concussion when he fell onto a weight after losing control, and another was bruised when he dropped a weight onto his upper back. In neither case has there been any evidence of a long-term consequence.… In short, there seems to be no rational case for continued widespread anxiety about weight training or weightlifting in children."[10]

Renowned Russian sport scientist Vladimir Zatsiorsky in his book *Science and Practice of Strength Training* had this to say about the potential for injury in weight training: "The risk of injury for a well-coached strength training program has been estimated to be about one per 10,000 athlete-exposures" [with an athlete-exposure being defined as one athlete taking part in one training session or competition]. "Compared to tackle football, alpine skiing, baseball pitching, and even sprint running, strength training is almost free of risk."[11] The simple truth is that weight training and the competitive lifting sports are among the safest activities an athlete can participate in, and this fact is known worldwide.

Siff said that it is ridiculous to condemn many sporting activities solely because of presumed increased risk of injury. "Many school sports place the bodies of youngsters in danger – it is the nature of sport and, if one is going to take part in any physical activities, no matter how well controlled, there is going to be a greater risk of injury than if the kids sat in front of the TV," says Siff. "On the other hand, the sort of heavy

Nick Sellers is 11 years old and the son of BFS clinician Jeff Sellers. Nick is a multi-sport athlete who is getting a head start into high-level athletics with a sound weight training program supervised by his father.

loading imposed on the child's growing body may well equip it better to cope with the normal physical stresses of life, as is suggested by research which reveals a high incidence of back pain, spinal dysfunction, osteoporosis and arthritis among people who are sedentary."

Although using lighter weights as recommended by many fitness and medical organizations seems the safest way to train, physics suggest otherwise. According to Siff, the lighter weights "can be accelerated more rapidly than heavier loads or in ways that deviate further from the body than heavy loads. This means that movement under these more modest conditions can produce much greater forces on the body, which is precisely what we are trying to minimize. We must not fall for the fallacy that training with heavy weights necessarily imposes greater forces and torques on the body. This simply is not true."

Although there is an emphasis in strength and conditioning programs to develop the core muscles of the body to develop stability, it's obvious to anyone who has ever performed a heavy squat that many of these so-called core muscles must work extremely hard to fight disruptive forces that occur during this exercise. Further, exercises such as the Olympic lifts (snatch and clean and jerk) and their many variations teach the athlete how to effectively control high-impact forces, just as a boxer learns to "take a punch" or a skier learns how to adjust their body position to maneuver on a course. As a bonus, exercises such as the Olympic lifts develop a high level of overall body coordination, which can help when learning new sport skills.

A Question of Supervision

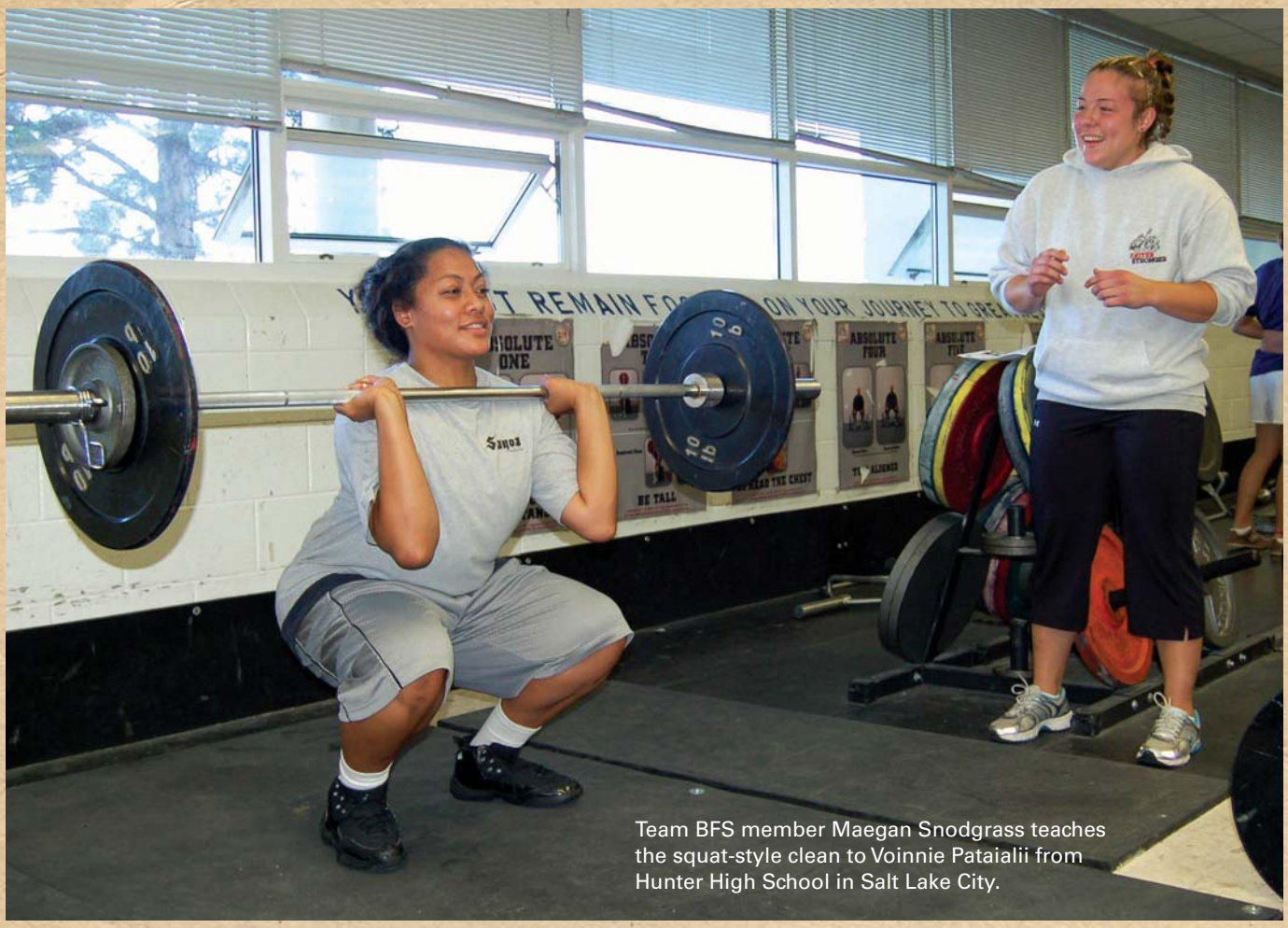
Whether you look at research studies, practical experience or the basic laws of science, the fact is that properly supervised weight training is safe for kids and can help prevent injuries and increase performance. It's not risk free, but it is certainly safer than most sports. To minimize the risk, BFS holds clinics not only to teach young athletes how to lift and spot properly but also to instruct coaches in how to teach proper technique. As the proverb goes, "Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime."

When looking at the issue of having young athletes weight-train from a legal perspective, coaches and teachers named in lawsuits must provide evidence that what they were doing was professionally correct according to current standards and that the injury was unforeseeable. For this reason, BFS recommends that anyone in the field of exercise instruction obtain a degree, whether it is an associate degree or a four-year degree in such areas as human performance and sport sciences, physical education, adult fitness or exercise science. Such an education would help a coach determine when an athlete is ready to advance into heavy weight training, as the fact is that athletes often mature at different rates. Thus, a 13-year-old girl may have the physical maturity of an 11-year-old girl, whereas another 13-year-old girl may have the physical maturity of a 15-year-old girl.

After earning a degree, the coach should then focus on becoming certified through organizations such as BFS to learn the most current methods of training for athletic fitness. One such program is our Readiness Program, which is designed to teach the basics of weight training to young athletes, particularly those in middle school.

At BFS, we believe that a properly supervised weight training program is appropriate for young athletes, and that the best time to start teaching proper weight training, lifting and spotting techniques is in middle school. We also believe that the preponderance of research available on this subject shows that weight training does not present a high risk of injury, especially to the growth plates of young athletes. Finally, we believe that as our young athletes strive to achieve the highest levels in competitive sports, they must participate in serious training at a younger age than the champions of the past. For young bodies to handle the stress of this training safely, weight training is essential. BFS

Note: A PDF of the complete position paper is available for free download at www.biggerfasterstronger.com



Team BFS member Maegan Snodgrass teaches the squat-style clean to Voinnie Pataialii from Hunter High School in Salt Lake City.

BFS POSITION PAPER

Strength Training for Women

Guidelines for helping women fulfill their athletic potential

With all the information available about strength and conditioning, it's amazing that there are still many myths being promoted about women and strength training. You'll hear Pilates instructors claim that their workouts are better for women because their techniques will make muscles longer, like a ballerina's. There are highly paid celebrity fitness trainers who preach that women should only do light weights to tone. Some health care providers claim that heavy squats will damage a woman's knees, spine and possibly even their ability to bear children! And of course, there is the almost universal belief that all women athletes must do aerobic exercise to stay lean. All of these beliefs are nonsense, but the damage has been done.

The continual reinforcement of such misinformation about training women athletes by these so-called experts has trickled down to our schools. The result is that young women are given programs that are vastly different from, and usually inferior to, those given to men. This paper will discuss 10 myths associated with training young women so that coaches, athletes and their parents can understand how young women can achieve their full physical potential.

MYTH 1: Weight Training Makes Women More Masculine. Many women have avoided weights because of the ill-fated sport of women's bodybuilding, which produced hundreds of Hulk-like females in the 1980s and still churns out a handful of new, chemically enhanced exhibitionists a year. The fact is the average woman cannot gain huge muscle without the assistance of muscle-building drugs.

Biologically speaking, most girls who train for strength or muscular gains will never acquire the degree of muscle mass associated with boys who lift weights simply because girls have much less of the muscle-building hormone testosterone compared to males. Women also possess only about 60 percent of the number of muscle-fiber nuclei that men have, which reduces women's capacity to build muscle.[1]

It's true that strength gains are often associated with increased bodyweight, but this does not necessarily mean there is always an increase in size. Muscle tissue is denser than fat, so as a female athlete trains for strength, her bodyfat is likely to decrease while her muscle tissue increases, causing her overall bodyweight to increase or stay the same.[2] Also, many elite strength coaches have found that female athletes often experience their largest gains in muscle mass during the first year of training, with gains in strength in the following years coming primarily through neural adaptations.[3]

MYTH 2: Women Cannot Excel in Overhead Lifting, Chin-ups and Push-ups. The current world record in the clean and jerk for women is over 400 pounds, and now women are not only clean-and-jerking more than double bodyweight, but are snatching more than double bodyweight as well. In the squat, Becca Swanson holds the all-time best result in this lift, with 854 pounds while weighing 247 pounds. Such results prove that women can achieve exceptionally high levels of strength in the lower body. But what about the upper body?

Scientific research and empirical evidence suggest that women can make significant improvements in upper body strength if they decide to work on it. Young girls will be seen in gymnastics facilities climbing thick ropes and performing multiple chin-ups and handstand push-ups. "As far as chin-ups are concerned, this is the exercise where women are actually closest to men when trained properly," says Charles Poliquin, a strength coach who has worked with numerous women who have won medals in the Olympics and have broken world records. "They can attain, on a pound-for-pound basis, 85 percent of a man's strength." Poliquin notes that a female trainee (assuming she is not overweight) who is trained by a competent strength coach should be able to perform 12 chin-ups in three months. He also notes that pressing strength is typically less efficient in a woman, with the lifts often being 66 percent or less than a man's in various pressing exercises.[4] Incidentally, the world record for women in the bench press is 600 pounds.

One reason women generally do not excel in tests of upper body strength is that, historically, men, and boys as well, tend to perform more heavy labor than women do. Who climbs the tree to do the trimming, pulls down the broken fence, and wheelbarrows in the new sod? Girls and women do hard chores too, but much of the backbreaking stuff goes to the guys. So it may not be so much of a physiological issue as a cultural one.

MYTH 3: Aerobics Is the Best Way to Help Women Stay Lean. Women carry more fat and store it more efficiently than men, making it harder for them to maintain a lean, athletic body. By increasing muscle mass and stimulating the release of natural biochemicals such as growth hormone, anaerobic activities such as weight training will raise a woman's metabolism (the rate at which a body burns calories) and will help her burn fat and stay lean, perhaps even more effectively than aerobics will. Further, aerobics produces cortisol, which has the effect of decreasing muscle mass and consequently her metabolism.[5]

Many women believe that in order to stay lean they must perform aerobics. The fact is weight training appears to be more effective than aerobic training in reducing fat. In fact, it's possible to overtrain so much with aerobics that the body actually gains fat. One study found that the aerobic instructors who taught the most classes had the highest bodyfat levels! Further, some types of aerobic training, such as spinning, can increase the storage of intramuscular and subcutaneous fat in the hip and thigh areas.[6]

MYTH 4: Weight Training Can Stunt a Girl's Growth. One reason this myth has survived may be traced to the decreasing height of women gymnasts. In her fascinating book about female gymnasts and figure skaters, *Little Girls in Pretty Boxes*, Joan Ryan writes that the average height of the gymnasts on the 1976 US Olympic Team was 5 feet 3½ inches, whereas the average height of the 1992 US Olympic team was 4 feet 9 inches.[7] An uneducated assumption might be that the difference could be attributed to the ever-increasing intensity of the workouts these athletes perform. If you carried that argument to the next step, you'd expect that young girls who lift weights would experience the same reduction in height.

The fact is the average height of our top gymnasts has declined because of *selection*: Shorter athletes tend to be stronger, pound for pound, than taller athletes. This "relative strength" difference makes it more likely that shorter athletes will excel. Likewise, most figure

Photo: Bill Schaefer, Idaho State Journal

Photo: Dean Hendrickson

BFS HIGH SCHOOL FEMALE ATHLETES OF THE YEAR

2004: Sarah Cardinal
Blackfoot High School
Blackfoot, Idaho

2005: Valerie Davis
Wood Memorial High School
Oakland City, Indiana

2006: Jennifer Walter
Huntley Project High School
Wordon, Montana

skaters tend to be relatively short, even the men. A faulty analogy would be to say that if a child is short, they should take up basketball because most professional basketball players are tall.

As discussed in detail in articles published in *BFS* magazine, there is very little risk that weight training will stunt growth, either by prematurely closing growth plates or by some other means.[8] Further, weight training increases bone density, thereby decreasing the risk of women developing osteoporosis in later years.

MYTH 5: Women Cannot Train Like Men. One of the biggest challenges in designing strength training programs for girls at the high school level is that many girls have little or no weight training experience. It can be an intimidating experience for girls to be put in a coed class with boys who have had several years of weight training or, as stated earlier, more of a background in manual labor.

For these girls, it's best to start with a program of higher repetitions to help them learn and perfect proper lifting technique. This also makes sense from a biological perspective, as even with an equal level of weight training experience, women tend to be less "neurologically efficient" than men.[9] What this means is that girls can enjoy good progress for a longer period of time on higher repetitions than boys because it is more difficult for girls and women to recruit the most powerful fast-twitch muscle fibers. Also, at the highest levels of training, such as the programs of Chinese weightlifters, women tend to respond best to more frequent, but shorter, workouts than men.[10]

Science aside, from a practical standpoint a female athlete may be able to make better progress on the BFS program for an even longer period of time than a male athlete. So, whereas in college a male athlete who trains for one sport may do better on a sophisticated periodization model, a female athlete may do better on a workout program such as the Bigger Faster Stronger Total Program for Athletes.

MYTH 6: Women Are Not As Disciplined in the Weightroom As Men. Many high school coaches find that they get much better results when girls train by themselves instead of in a coed environment. Perhaps this reflects a lingering social taboo that it isn't OK for girls to be strong or that there is something unfeminine about a girl training to be fit. However, many coaches today find that there is no issue with girls training with boys, and often the girls will even help with the spotting. Whatever the reason, it's expected that as these social stereotypes break down, more young women will become increasingly comfortable in coed weight training environments.

MYTH 7: Women Should Not Play Certain Sports Because of the Risk of ACL Injuries. In volleyball, basketball and soccer, it's been estimated that women can be as much as eight times as likely as men to injure the anterior cruciate ligament, or ACL, which helps stabilize the knee. According to the American Orthopedic Society for Sports Medicine, each year approximately 20,000 high school girls suffer serious knee injuries, most involving the ACL.[11] Several theories have been proposed to determine why women are at such a high risk, including the idea that women have

Photo: Pat Connelly

2007: Kiley Allosso
Frank Cox High School
Virginia Beach, Virgina

2008: DeAnn Pertz
Titusville High School
Titusville, Pennsylvania

2009: Hannah Donnerberg
Lakeside High School
Plummer, Idaho

less strength than men and therefore rely more on their ligaments than on their muscles for support, and a women's wider pelvis causes a woman's thighs to angle inward and make her knees more vulnerable to injury.[12] What is commonly overlooked is that often women do not receive the same strength training programs as men, and as such may not be as prepared to handle the stress of high-level sports.

MYTH 8: Women Can't Train During Their Menstrual Cycle. Contrary to this archaic notion, women can train anytime, just as men can, provided their health is uncompromised. There are some studies suggesting that athletic performance may be inclined to rise at particular times during a woman's cycle, but research has produced no absolute conclusions. Training performance is always individual, and of course any medical concerns should be taken up with the appropriate medical providers available to the athlete.[13]

MYTH 9: Women Should Not Squat Because It Widens the Hips. This myth can be traced to Vince Gironda, a legendary bodybuilding guru who trained physique champions and movie stars. Gironda said that squats would widen the hips and detract from the aesthetic V-taper that bodybuilders like. According to Poliquin, there is no scientific or empirical evidence to corroborate the belief that squats widen the hips: "When the gluteus maximus develops, it grows back, not out, because neither the insertion nor the origin is at the hip. If squats did widen the hips, Olympic lifters, who devote as much as 25 percent of their training volume to squats, would be built like mailboxes."[14]

MYTH 10: America Has the Best Strength Training Programs for Women Athletes. For a number of reasons American women have been slow to begin programs designed to develop their optimal strength. This lack of serious strength training becomes most apparent when you look at the performance of our international-level female athletes in events such as the discus, shot put and javelin throw – sports that all require superior upper torso strength coupled with power from the hips, buttocks and thighs.

The fact that European and Eastern Bloc women dominate these power sports does not imply that they are made of tougher stuff, but it does mean that they use better training methods. American coaches are well aware of the benefits of long-term strength training programs: Progressive weight training programs and improved training facilities have been upping the poundages and increasing the strength of our male athletes for quite some time. But American athletic coaches have been reluctant to apply these same training techniques to our women athletes, and many of these women have themselves been reluctant to undertake a serious program for building muscular strength.

As social and cultural attitudes about strength training for women continue to become more positive, greater numbers of women will begin to pursue serious power training programs. Then we can look forward to a new influx of athletic talent who will continue to shatter the existing records for women strength athletes. BFS

Note: A PDF of the complete position paper is available for free download at www.biggerfasterstronger.com

Photo by Bruce Klemens

BFS POSITION PAPER

The Power Clean

Why BFS encourages all athletes to perform this valuable exercise

Although the power clean has become a mainstay in the conditioning programs of most athletic programs, many coaches are still reluctant to incorporate it into their training programs. Alternatively, they may choose to perform the exercise from only a partial range of motion or they may discourage younger athletes from practicing it. Or, even worse, many coaches will not undergo the training to teach it properly. This paper will address all these issues.

The field of strength and conditioning has evolved, and now weight-rooms have become not only large but also overwhelmed with training fads promoted by sports celebrities and large marketing budgets. Swiss balls, wobble boards, foam rollers, suspension cords, kettle bells, strongman yokes, tires…every year a different new fad is brought forth in the hopes of getting an edge. The problem is not that these devices are without any value but that they distract from the basics of developing stronger, more powerful athletes.

This is especially true in high schools. Often, two or three training sessions, about 45 minutes each, are all that can be devoted to workouts. During the season, two weight training workouts may be all that athletes can fit into their schedule. What's more, because most high school athletes compete in multiple sports, preseason periods often last only a few weeks. This means that for the majority of the year, an athlete may have only two training sessions a week, and sometimes fewer. Time is precious, and high school athletes must make every minute count.

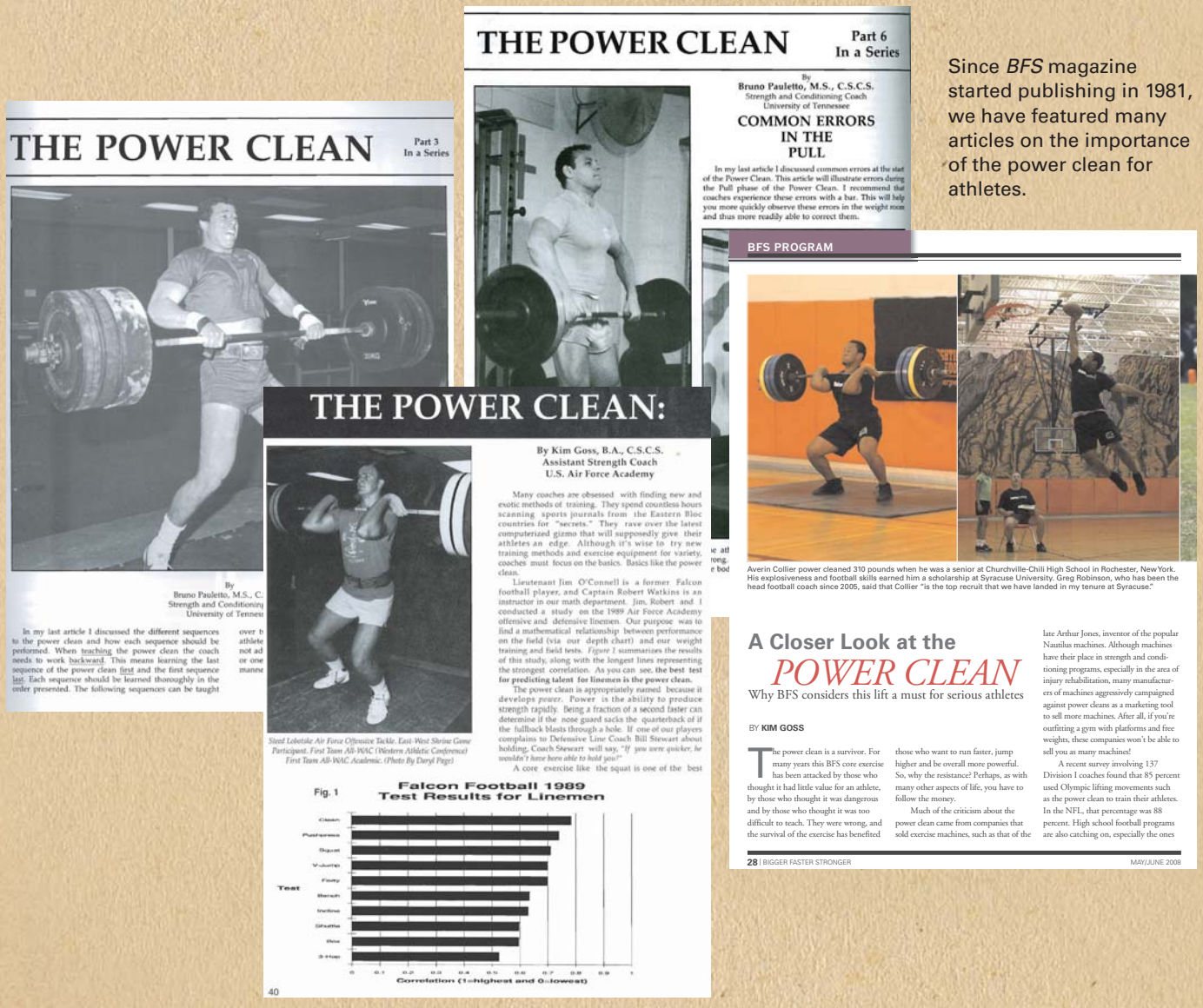
Why Athletes Need the Power Clean

If you peruse the archives section of *BFS* magazine online, you'll see that from our very first issue in 1981 we have been promoting the power clean. In the early years, many individuals believed that the power clean had little value for an athlete or was too dangerous. Why? Perhaps, as with many other aspects of life, you have to follow the money.

Much of the criticism about the power clean came from companies that sold exercise machines, such as that of the late Arthur Jones, inventor of the popular Nautilus machines and one of the most prolific writers in weight training. Although machines have their place in strength and conditioning programs, especially in the area of muscle building and injury rehabilitation, many manufacturers of machines aggressively campaigned against power cleans as a marketing tool to sell more machines. After all, if you're outfitting a gym with platforms and free weights, these companies won't be able to sell you as many machines! But the fact is they were wrong.

A survey involving 137 Division I coaches found that 85 percent used Olympic lifting movements such as the power clean to train their athletes. In the NFL, that percentage was 88 percent. When *BFS* Editor in Chief Kim Goss was a strength coach for the Air Force Academy (1987-1994), he enlisted the help of the university's math department to conduct an experiment to determine which strength training exercises had the highest correlation to the ability to play football. He compiled the results of the top three athletes on the depth chart for each position, as well as their maxes on numerous core and auxiliary exercises, for a three-year period. For defensive and offensive linemen, and in fact for almost all positions, the exercise that had the highest correlation to playing ability was the power clean. The reason is simple.

Linemen need to be able to express a high level of strength quickly. Because the power clean allows you to accelerate your limbs over a large range of motion, it's one of the best exercises for improving what sport scientists call the *rate of force development*. This is in contrast to conventional power lifts such as squats, which for safety reasons require more time to decelerate the weight – in fact, the only time maximum force can be



THE POWER CLEAN Part 3 In a Series

By Bruno Pauletto, M.S., C.

In my last article I discussed the different sequences to the power clean and how each sequence should be performed. When teaching the power clean the coach needs to work backward. This means learning the last sequence of the power clean first and the first sequence last. Each sequence should be learned thoroughly in the order presented. The following sequences can be taught

THE POWER CLEAN Part 6 In a Series

By Bruno Pauletto, M.S., C.S.C.S. Strength and Conditioning Coach University of Tennessee

COMMON ERRORS IN THE PULL

In my last article I discussed common errors at the start of the Power Clean. This article will illustrate errors during the Pull phase of the Power Clean. I recommend that coaches experience these errors with a bar. This will help you more quickly observe these errors in the weight room and thus more readily able to correct them.

THE POWER CLEAN:

By Kim Goss, B.A., C.S.C.S. Assistant Strength Coach U.S. Air Force Academy

Many coaches are obsessed with finding new and exotic methods of training. They spend countless hours scanning sports journals from the Eastern Bloc countries for "secrets." They rave over the latest computerized gizmo that will supposedly give their athletes an edge. Although it's wise to try new training methods and exercise equipment for variety, coaches must focus on the basics. Basics like the power clean.

Lieutenant Jim O'Connell is a former Falcon football player, and Captain Robert Watkins is an instructor in our math department. Jim, Robert and I conducted a study on the 1989 Air Force Academy offensive and defensive linemen. Our purpose was to find a mathematical relationship between performance on the field (via our depth chart) and our weight training and field tests. *Figure 1* summarizes the results of this study, along with the longest lines representing the strongest correlation. As you can see, **the best test for predicting talent for linemen is the power clean.**

The power clean is appropriately named because it develops *power*. Power is the ability to produce strength rapidly. Being a fraction of a second faster can determine if the nose guard sacks the quarterback or if the fullback blasts through a hole. If one of our players complains to Defensive Line Coach Bill Stewart about holding, Coach Stewart will say, *"If you were quicker, he wouldn't have been able to hold you!"*

A core exercise like the squat is one of the best

Steed Lobotzke Air Force Offensive Tackle. East-West Shrine Game Participant. First Team All-WAC (Western Athletic Conference) First Team All-WAC Academic. (Photo by Daryl Pege)

Fig. 1 Falcon Football 1989 Test Results for Linemen

40

Since *BFS* magazine started publishing in 1981, we have featured many articles on the importance of the power clean for athletes.

BFS PROGRAM

Averin Collier power cleaned 310 pounds when he was a senior at Churchville-Chili High School in Rochester, New York. His explosiveness and football skills earned him a scholarship at Syracuse University. Greg Robinson, who has been the head football coach since 2005, said that Collier "is the top recruit that we have landed in my tenure at Syracuse."

A Closer Look at the *POWER CLEAN*

Why BFS considers this lift a must for serious athletes

BY KIM GOSS

The power clean is a survivor. For many years this BFS core exercise has been attacked by those who thought it had little value for an athlete, by those who thought it was dangerous and by those who thought it was too difficult to teach. They were wrong, and the survival of the exercise has benefited those who want to run faster, jump higher and be overall more powerful. So, why the resistance? Perhaps, as with many other aspects of life, you have to follow the money.

Much of the criticism about the power clean came from companies that sold exercise machines, such as that of the late Arthur Jones, inventor of the popular Nautilus machines. Although machines have their place in strength and conditioning programs, especially in the area of injury rehabilitation, many manufacturers of machines aggressively campaigned against power cleans as a marketing tool to sell more machines. After all, if you're outfitting a gym with platforms and free weights, these companies won't be able to sell you as many machines!

A recent survey involving 137 Division I coaches found that 85 percent used Olympic lifting movements such as the power clean to train their athletes. In the NFL, that percentage was 88 percent. High school football programs are also catching on, especially the ones

28 | BIGGER FASTER STRONGER MAY/JUNE 2008

exerted is at the beginning of those exercises. And there is practical evidence in peer-reviewed journals supporting the idea that power cleans are a superior exercise for developing power.

For example, in 2004 researchers at the Department of Health and Exercise Science at the College of New Jersey conducted a 15-week study on weightlifting exercises involving 20 Division III college players. One group focused on powerlifting ("PL") exercises such as the squat, while the other group focused on Olympic lifting ("OL") exercises such as the power clean. Although both groups showed improvements in the vertical jump, a standard test for athletic power, the authors noted, "Results suggest that OL can provide a significant advantage over PL in vertical jump performance changes." There are many physiological reasons for this, such as what type of muscle fibers the power clean works.

There are essentially two types of fast-twitch muscle fibers that can increase in size: the Type IIa and the more powerful Type IIb. The Type IIb fibers respond better to explosive lifts such as the power clean; and much of the massive development of the traps, lower back and hamstring muscles on Olympic lifters is due to the development of Type IIb fibers. So, if you want as much functional muscle mass as possible for sports, you need to perform the power clean.

But what about the idea that the power clean is dangerous? This subject of weight training safety is covered extensively in the BFS position papers on safety and liability and youth training. For example, the youth training paper reported that a study conducted in the United Kingdom found that the lowest injury rate was in the sport of competitive weightlifting, with a .0017 rate (0.17 percent). The authors noted the following: "Britain's Schoolboy Championship has been staged annually for at least 18 years and has involved some 54,600 competition lifts (maximal or nearly so) and at least 54,600 lighter but still heavy warm-up lifts. In this period one boy suffered a concussion when he fell onto a weight after losing control, and another was bruised when he dropped a weight onto his upper back. In neither case has there been any evidence of a long-term consequence.… In short, there seems to be no rational case for continued widespread anxiety about weight training or weightlifting in children."


Jordon Cedarstrom


Lusia Angilau


Lynn Weikel


Cyrene Ekezie Wittman

Hunter High School in Salt Lake City has a great girls weight training class that stresses the power clean. The class currently has five girls who have cleaned at least 150 pounds and ten who have cleaned 135. The athletic director and coach for the class is Heather Sonne.


Janae Gardner


Lindly Fernandez


Ashley Gibson

It should also be noted that during a power clean the athlete not only must explosively lift the weight but also must catch it. In effect, doing power cleans teaches the athlete to rapidly control the impact, a.k.a. *disrupted forces*, that occur during the lift. When you consider the ever-increasing numbers of athletes suffering ACL injuries, you can see how valuable it is to be able to handle the dynamic, disrupted forces that occur to the ankle and knee during athletic competition. Further, the faster that athletes can handle these disrupted forces, the quicker they will be able to move on the court or on the field.

Finally, the Olympic lifts are "economical" exercises, meaning that they work many muscle groups simultaneously. To achieve a similar training effect with conventional exercises, an athlete would have to perform a leg press, back extension, calf raise, shoulder shrug, upright row and biceps curl – and even then they would be neglecting a few muscles. Time is a major limiting factor in many athletic programs, so it's important to use exercises such as the power clean that give you the most bang for your buck.

Is the Power Clean Safe?

One of the current trends among coaches is to have athletes perform the lift just from the mid-thigh position, also known as the "hang." Addressing this issue is Bud Charniga, one of the best lifters in the US (he was only five pounds away from an American record in the snatch in the '70s) and an individual who has translated many Russian weightlifting textbooks and has talked to the world's best coaches at many international weightlifting competitions. He was asked why so many coaches prefer the hang variation of the power clean rather than lifting it from the floor.

Every May Bonanza High School hosts the National High School Power Clean Championships, attracting great athletes such as Dustin Dillard from Churchville Chili High School in Rochester, New York. For more information contact Val Balison at *vjbalison@cox.net*.

"Why do many athletes only perform the hang clean? I believe it's because they don't develop the flexibility in the knee, hips and ankles, so they shorten the range of motion. They shorten the range of motion – you don't have to worry about flexibility. The problem with doing it from the hang is that you tend to use your arms too much and you flex your legs less – so basically you're going to be lifting the weight with your upper body."

Is the power clean difficult to teach? Certainly not, if you have the proper educational materials and coaches who know how to teach it. BFS currently gives more than 400 clinics a year to young athletes and has been doing so for over 30 years. The power clean is taught in all these clinics, and we often see athletes who have never performed this exercise come away with sound technique that will quickly lead to gains in athletic performance. Further, at our certification clinics, we ensure quality instruction, because coaches must show not only that they can perform the power clean at these clinics but also that they can teach it. But coaches should not stop there.

For further help with teaching and performing this exercise, the US Weightlifting Federation offers clinics on how to perform not just the power clean but also the power snatch and the full variations of these lifts, the snatch and the clean and jerk. And Charniga, through his website *sportivnypress.com*, offers many free translated articles about Russian weightlifting training methods. Charniga says that the whole point of doing those exercises is that "they are complicated, and it requires coordination, flexibility, agility – all that comes together into a complete motion." So, just as a football coach would not read one book in their entire career about how to coach their sport, a strength coach should make learning how to perform the power clean and its variations a lifelong learning process.

The power clean is one of the single most important exercises for achieving physical superiority, which is why it has always been a core exercise in the BFS program. Therefore, coaches should take the time to learn how to teach the power clean correctly so their athletes have the best chance to fulfill their potential. BFS