SPORTS SCIENCE EXCHANGE

ROUND TABLE

STRENGTH AND CONDITIONING PROGRAMS:
ANSWERS FROM THE EXPERTS

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Introduction

Nearly everybody who has ever lifted a weight or spent time in a gymnasium or health club has an opinion on the “best” way to strength train. However, in recent years the science of strength development has grown dramatically, and new and proper techniques are based more on objective scientific discovery than on anecdotal information or testimonials. The size, speed, and strength of the modern day athlete attests to our growing knowledge in the fields of strength training and conditioning.

The Gatorade Sports Science Institute polled a panel of experts regarding their beliefs on strength training for women and children, strength training during pregnancy, the need for nutritional supplements as part of a training regime, and various other issues regarding strength development. Our panel is comprised of athletic trainers, certified strength coaches, a physical therapist, and an orthopedic surgeon/strength coach. In addition to their insights on developing strength training programs, our panel discussed the similarities and differences in the roles of the athletic trainer and the strength coach, and the importance of both professions as part of an effective sports medicine team.
At what age is it safe to begin a strength training program?

Satterwhite: Fundamental motor development is complete in most children by the time they reach seven years of age. Thus, by age eight or nine years children have the basic foundation of skills for coordination, balance, and agility, and the motor maturity to permit them to successfully participate in a supervised light strength training program. In addition to modest realistic strength gains, the goals in this age group should be to begin to develop good form, technique, and confidence.

Due to ethical considerations, there is a paucity of data from clinical studies outlining the loads that growth plates in the skeletally immature child can withstand without permanent damage, i.e. growth arrest or inhibition. Therefore, caution should be advised when coaching children and adolescents to avoid any possible detrimental effects of strength training.

Chu: The issue of age and strength training is an age-old debate. The National Strength and Conditioning Association (N.S.C.A.) position paper on strength training for pre-pubescents states that high intensity (heavy load) lifting should not begin prior to the age of maturity (<13 yr.). This is a somewhat arbitrary age, as physical maturity usually occurs at different times in different children. Prior to the age of maturity, strength training with lighter loads may be done. However, there is absolutely nothing wrong with teaching the techniques necessary for effective lifting before physical maturity takes place. The establishment of motor pathways for this type of activity at an early age can lead to greater success as the athlete moves into maturity.

Schmidt: I believe that children at the junior high school level can generally begin to train, at about the time that they begin competitive sport activities. Young athletes should begin with a program of body weight-type exercises (e.g. pull-ups, push-ups, sit-ups), eventually moving into major exercises with free weights or training machines.

Reeland: I don’t believe that true strength training should begin until about the age of sixteen. As Dr. Satterwhite suggested, we have to give the growth plates a chance to solidify before exposing young children to the stress and rigors of strength training.

Wathen: I have two general rules for pre-pubescent lifting. 1- Proper supervision on site; and 2- the child must want to participate in the activity. As Dr. Chu mentioned, guidelines for adolescent lifting can by obtained from the N.S.C.A and other organizations, but the child’s interests must be taken into account above all else.

Are there significant differences in strength development programs for men and women? Is strength training safe during pregnancy?

Wathen: Men are generally stronger than women due to a larger muscle mass. However, strength training programs need not differ significantly for men and women. During pregnancy, one major rule for any type of physical training should be to not impose high stress. Weight training should not be introduced during pregnancy, but may be continued by women who are already strength training. In general, strength training should consist of moderate/light resistance, with no breath holding. No extremes in joint flexion should be attempted, as the joints become looser during the final trimester. Supine positions should also be avoided after the second trimester.

Schmidt: Both men and women can benefit from strength training programs. However, it may be necessary to adjust programs to target key areas according to sex differences. For example, many women tend to lack strength in the shoulders, triceps, and chest areas. Therefore, it may be beneficial for women to begin with more basic body weight exercises to build strength in these areas before progressing to more difficult exercises.

As Dan Wathen suggested, strength training during pregnancy can be done safely if proper precautions are taken. Light-to-moderate weight loads should be used for 12-15 repetitions to avoid extreme elevations in blood pressure and heart rate. It is also suggested that abdominal exercises for pregnant women be different than the normal abdominal routine. A physician should be consulted before commencing an abdominal program during pregnancy. Lastly, altered hydration and nutritional needs during exercise in pregnancy should be considered and discussed with a physician as well.

Chu: There are no major differences that need to be considered between the sexes, except possibly differing goals. If women wish to avoid “large” muscles they need to be aware of the effects of various training regimens on the body. It is apparent from research that the volume of lifting is the key in developing muscle mass. High numbers of sets (5-8) and moderately high numbers of repetitions (8-10) will tend to build more muscle mass than other volume/intensity schemes.

Regardless, the fact that males possess higher levels of testosterone than women may make the issue of women and muscle mass somewhat of a moot point. However, certain training schemes coupled with a genetic tendency to increase mass can result in rather large muscle mass gains in some women.

The question of strength training and pregnancy must take into account many factors, and strength training should only be performed with the permission of a physician. The hormonal, physiological, and body conformational changes that occur during pregnancy will force an adjustment in any exercise program. The goal of the pregnant individual should be to maintain the highest level of fitness, consistent with maximum safety.

Satterwhite: The response of muscles to training is the same for men and women. Ultimate strength and power gains vary, of course, due to morphological and hormonal differences. As the other respondents have stated, strength development programs should be basically the same for males and females with regard to the core exercises. Auxiliary or secondary exercises, as well as the volume and frequency of training should be directed at being sport specific more than gender specific.

The American College of Obstetrics and Gynecology has developed a set of exercise guidelines for the pregnant female. Women should certainly consult their physician for individual restrictions or special limitations that they should observe. In general, strength training, flexibility, and aerobic exercises during pregnancy have many benefits, including potentially easier pregnancy and shorter labor as well as reduced back pain.

What are the pros and cons of free weights versus variable resistance machines?

Schmidt: The number one factor in any strength training program is safety. In public gyms and health clubs, for example, where large numbers of people exercise with limited supervision, variable resistance machines are a viable option. However, free weights promote quicker strength gains and they require more balance and coordination than do the weight machines. Therefore, they would be my first choice for sports specific training.

Reeland: Free weights are the exercise mode of choice in almost all collegiate weight rooms. Free weights recruit more muscle groups than variable resistance machines, which tend to only isolate specific muscles.
Variable resistance machines have their place in serious weight training programs and are favored by older individuals or recreational lifters. For the younger athlete hoping to make large strength gains, however, research studies have shown that free weights are the most appropriate strength training tool.

Wathen: Free weights are more versatile than variable resistance machines in that they allow for more variations in lifting patterns. Furthermore, very strong individuals can often lift all of the available resistance on many of the machines. Free weights require balance, and they tend to promote more activity of the joint stabilizer muscles. Finally, they are considerably less expensive than most of the machines on the market.

Satterwhite: In my opinion, an ideal training program incorporates both free weights and variable resistance machines in order to elicit multiple muscle/joint and isolated muscle/joint work. Public and collegiate gyms generally provide access to both types of equipment. Junior high and high school gyms may have free weights but rarely do they have a wide variety of variable resistance machines due to financial limitations. Unfortunately, some schools do not have a weight room at all. In the latter situation I certainly advocate that, when finances permit, the school first obtain free weights since a myriad of exercises may be performed with an Olympic bar, a few dumbbells, and a little imagination.

When rehabilitating injured athletes, variable resistance machines can provide a more controlled environment by specifically isolating certain muscle groups, and by increasing the protective participation of the healthy limb or muscle group.

Chu: I think that availability is a key factor in one’s choice of weight training equipment. If an individual finds weight machines to be more readily available and they feel comfortable using them, that is likely the method they will use. However, if a person is willing to make a commitment to learning new skills, to practicing more complex training patterns, and to best enhance their strength and performance gains, they will likely seek out free weights.

Under what circumstances are the use of nutritional supplements justified by strength-training athletes?

Reeland: In general, I don’t think that strength-training athletes need to rely on nutritional supplements if they are eating a good, balanced diet. Furthermore, I believe that an individual should seek the advice of a medical professional who can document evidence of a nutritional deficiency before they self-prescribe a supplement.

Schmidt: I agree with Doug’s assertion that an athlete who consistently consumes a nutritionally balanced diet does not generally need supplements. However, because of hectic schedules and the heavy physical demands of intense training many athletes find it difficult to consume a well-balanced diet. Under these circumstances, a well-researched supplement may be beneficial. In many cases, a high carbohydrate product is beneficial for extra endurance demands and recovery. When taken in liquid form, it can also serve the purpose of rehydrating the athlete.

Satterwhite: I am also of the belief that supplements can become important when the nutritional needs of the athlete cannot be met effectively through a balanced diet alone or when chronic deficiencies (vitamin or mineral) need to be corrected. This situation is unusual for most athletes, but it does occur. Maximum strength and power gains require daily replenishment of protein and glycogen stores to support increases in lean body mass during intensive training. Replenishment can be routinely accomplished through oral ingestion of food and drink. Protein powders and carbohydrate drinks are popular supplements and can effectively increase one’s total daily caloric intake, especially in those athletes whose daily caloric needs are so high that ingestion of the necessary amounts of food becomes difficult.

Chu: In many instances, however, it is a “buyer beware” market in the supplementation field. Factual information is sometimes difficult to come by, and I have difficulty with nutritional claims that are not supported by research that is published in referred journals.

Wathen: It is sometimes difficult to differentiate fact from fantasy with respect to many nutritional claims. That is why it is important to seek the advice of a dietitian or another health professional who is well-educated in the field of nutrition. There are some excellent resources out there if you are willing to look for them. Journals such as Medicine and Science in Sports and Exercise, The International Journal of Sports Nutrition, The N.A.T.A. Journal, The N.S.C.A. Journal, The Journal of the American Dietetic Association, and the materials produced by The Gatorade Sports Science Institute all contain information that can help an athlete decide whether or not to use a particular supplement.

Many people have difficulty differentiating the roles of the athletic trainer from those of a certified strength coach. What are the general duties of these two groups of health professionals?

Chu: Strength coaches and athletic trainers do have competencies and a knowledge base that do, at times, overlap. However, I think that the two groups do see their roles as being different from one another. Traditionally, the athletic trainer has not relished the role of being a strength coach. They tend to deal with strength training as it relates to rehabilitation situations. Strength coaches tend to be involved more in re-conditioning and performance enhancement.

The field of strength training is relatively new. Presently, there are only two schools in the country that have curricula designed to prepare an individual to be a strength coach, and both of these programs have only been in existence for a few years. Until recently, teams, schools, and individuals relied on anecdotal information or experience to devise training programs. The establishment of the National Strength and Conditioning Association as the major certifying organization for strength coaches has improved the quality and knowledge base of individuals who consider themselves expert practitioners of strength training, and it has helped to move the field forward. A best case scenario is to have the athletic trainer and the strength coach working together to enhance the recovery and performance of the athletes with whom they work.

Wathen: I have worn the hats of the strength coach and the athletic trainer during the past twenty years, and it is my experience that communication between all members of the sports medicine team is necessary to insure proper treatment of the athlete. Generally, the team physician is in charge of the sports medicine team. The strength and conditioning specialist works with the athletic trainer in the areas of reconditioning and rehabilitation. The strength specialist generally designs and implements conditioning programs for healthy athletes. In this process, there should be input from the athletic trainer on matters of injury prevention. During the rehabilitation process the athletic trainer may direct the strength specialist as to when various activities can be introduced. Areas of disagreement can generally be settled by the team physician, who has ultimate responsibility. I find that keeping up with the scientific literature, and knowing the most current forms of treatment are excellent ways to avoid disagreements, and maintain a collaborative effort among all team members.
Reeland: The goals of the athletic trainer and the strength specialist are the same—to get their athletes in the best physical and mental condition so that they can perform optimally. As was mentioned previously, communication between the two groups has to be open all the time. Both the trainer and the strength coach are important cogs in the wheel of any athletic department, and they must keep each other informed on the conditioning techniques that are being employed by a particular athlete, as well as any injuries that the athlete might be experiencing.

Schmidt: At one time the athletic trainer had to coordinate three very important areas—strength development, rehabilitation, and nutrition. The strength and conditioning specialist has enabled the trainer to concentrate fully on the prevention and rehabilitation of injuries. In general, the strength and conditioning coach has a greater opportunity to educate athletes on an ongoing basis in the areas of conditioning and nutrition because of the greater number of daily contacts he has with the athletes.

Satterwhite: I agree with the other respondents who have stated that the common goal of the strength coach and the athletic trainer is to maximize performance while maintaining good health in the competitive athlete. The strength and conditioning specialist designs the sport-specific training program for each individual athlete, assists the athlete in realizing his or her potential, and identifies performance weaknesses that can be modified through training and diet. The athletic trainer should primarily be concerned with injury prevention, the identification of injuries or potentially injurious conditions in each athlete, and the initiation of treatment and/or referral of the athlete to the appropriate team physician for clinical evaluation and further recommendations. Furthermore, the trainer is responsible for providing assistance in the athletes recovery from injury, acting as a liaison between the strength coach and the physician. A working relationship based on respect for the expertise of all who are involved in managing and directing the skill development or rehabilitation of the athlete allows for the best opportunity for achieving desired results safely and efficaciously.

References:


This issue of the Sports Science Exchange Roundtable was coordinated and moderated by Bobby Barton, Ed.D., ATC Head Athletic Trainer, Eastern Kentucky University, Chris Patrick, M.S., ATC, Head Athletic Trainer, University of Florida, and Mitchell Kanter, Ph.D., Senior Research Scientist, Gatorade Exercise Physiology Laboratory & Director, Gatorade Sports Science Institute.

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