Overhead Strength Training for the Shoulder: Guidelines for Injury Prevention and Performance Training Success

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Strength training is an important component in the overall performance training of an athlete. With both technique and skill being equal, a stronger athlete has a definitive advantage over their weaker opponent. Often associated with the training of the overhead performance athlete, (i.e. baseball players/throwers, tennis/racquet players, etc…) there is a concern by many coaches and athletes with the incorporation of overhead strength training as part of their athletic performance training program. These coaches and athletes fear that this type of strength training may be detrimental to the athlete, causing possible injury to the shoulder and more specifically to the rotator cuff, thus prohibiting optimal athletic performance.

There undoubtedly are times when many medical professionals, including my associates and myself, have cared for athletes with various shoulder pathologies due to their use of overhead strength training. However, there have also been instances where we have cared for many individuals who have also arrived at our clinics having been injured performing a variety of strength training exercises emphasizing various parts of the body (i.e. low back, elbows, knees, etc…). Based on these rehabilitation experiences are we to surmise that all strength training exercises are detrimental to the body? Those select coaches and athletes that have the opinion that overhead strength type exercises are detrimental to the athlete's shoulder, usually have this opinion due to either "hear say" or a negative overhead strength training experience.

Over my many years of professional practice in both Sports Rehabilitation and the Performance Training of Athletes, I have had many discussions with the individual coaches and athletes who have experienced a negative overhead strength training experience. During the course of our conversation, these individuals have expressed what appears to be; in their opinion, the three most common circumstances that they believed had led to their negative experience. All felt that at least one if not more of the following events/circumstances had occurred during their overhead strength training resulting in their negative experience. The three events/circumstances that were most often described are as follows:

1. Prior to the initiation of the athletes Performance Training there was no form of pre-training screening performed.

2. The program design was inappropriate for the athlete, i.e. excessive exercise volume and/or the weight intensity to be repetitively lifted was too heavy.

3. The athlete's repeated performance of the overhead exercises was executed with incorrect/poor technique.

With this information considered, one may ask are overhead strength training exercises actually bad for the athlete or are they labeled bad for the athlete?

When prescribing overhead strength training exercises to the athletes training program, certain guidelines/criteria are essential to ensure not only success in the exercise performance and athletic enhancement, but also to minimize the possible incidence of shoulder injury. These guidelines have assisted us at our Athletic Performance Training Center with the successful utilization of overhead strength training with our athletes while reducing our concern for possible shoulder injury.

Overhead Strength Training Guidelines

1. The athlete must be medically appropriate for the performance of the prescribed overhead strength exercise.

A review of the athlete's medical history, as well as the medical and/or performance professional's evaluation process should provide significant information for consideration if the performance of overhead strength training is appropriate. Some examples of concern, specifically in regard to the shoulder, would include any history of surgical procedures, history of chronic tendonitis, the presence of a rotator cuff or labral tears, anatomical structural factors i.e. type II or III acromion, tight internal rotators, winging scapula, and fixed kyphotic posture in adults, to name a few. Presence of these findings does not necessarily prohibit the use of these overhead strength type exercises, but if deemed appropriate, may require necessary modification to ensure both safe and effective exercise performance.

2. Whenever possible perform all overhead lifts in the standing position.

Athletes compete and perform on their feet. The most successful athletes in the world are those that can generate the greatest amount of force into the ground surface area. These athletes run the fastest, jump the highest, and are generally the most powerful on the field of play. The legs initiate such athletic skill movements as pitching/throwing, swinging a bat/golf club/tennis racquet, shooting in hockey and lacrosse, kicking and punting, as well as the initiation of striking that occurs in martial arts, and boxing to name a few. If successful athletic performance occurs with the initiation of the legs on the ground surface area, then shouldn't the athlete train, whenever possible, in the same manner? Prescribing exercises such as the push press, push jerk, split jerk, etc…initiate the movement of the exercise with the legs, displacing force in the ground surface area with the athlete in the standing position. The force generated by the lower extremities pass through the body via the kinetic chain to the upper extremities to perform and complete the exercise. During athletic competition an athlete, unless they are a race car driver, is usually in a seated position only if they are not playing (seated on the bench) or knocked on their butt.

A second preference for the standing position is that the athlete can perform the exercise without restriction as optimal shoulder muscle activity and range of motion (ROM) at the gleno-humeral and scapulo-thoracic joints are free to move without obstructive contact from any type of outside surface. Surface contact during exercise performance may alter scapula- thoracic and gleno-humeral movement and kinematics, as well as the efficiency of muscle contribution during overhead exercise performance.

3. Do not use a bench when performing an overhead lift

There are two basic reasons why I am of the opinion an athlete should not to utilize a bench during the exercise performance of overhead strength training. The first reason is when an athlete uses a bench to perform an overhead pressing type exercise for shoulder enhancement; they are usually in a seated, not standing position. The preference for performing these exercises from the standing position has previously been discussed. An exception would be when training an injured or post-operative lower extremity athlete during the same period when the athlete is also performing their lower extremity rehabilitation. Prohibiting the athlete of a full weight bearing status will also prohibit the incorporation of any exercise performed in the standing position.

To elaborate further, the second reason to avoid overhead lifting from a seated position is as the athlete performs an overhead strength exercise from this position they will often utilize a bench that has a seat back attached to it. As the athlete is seated and positions themselves against the seat back, a "compressive force" is created at the scapula-thoracic joint of the shoulder. This force occurs as the scapula is "compressed" between the bench and the thorax via the weight of the body in addition to the weight to be lifted. There is an association between compressive forces and joint stability (one of the reasons that validate the use of lower extremity closed kinetic chain exercises). The "scapula stability" that occurs due to compressive forces caused by the exercise bench creates two potentially dangerous situations.

By compressing or "pinning" the scapula to the back of the bench, the gleno-humeral/scapulo-thoracic rhythm of the shoulder may be altered. This shoulder rhythm is necessary for a safe and normal functional movement of the upper extremity as it travels overhead. This exercise induced "alteration" may create an abnormal gleno-humeral/scapulo-thoracic rhythm during the performance of repetitive overhead movements. These "altered" repetitive overhead movements performed over a prolonged period of time may expose the athletes shoulder to potential injury.

The second concern with this exercise position is that this "compressive stability" at the scapula, may require less muscle activity from the muscle force couples and stabilizers of the scapula during the performance of the overhead movement. Due to these compressive forces, scapula stability is now somewhat "artificially" induced. As the deltoid muscle group continues to increase in strength via exercise performance, the scapula stabilizers and force couples get a "free ride" due to this "stability via compression"; hence their strength development may lag behind. This scenario may create a strength imbalance between the scapular musculature and the associated musculature that attach to the scapula (i.e. rotator cuff) with the deltoid muscle group. Due to the strong superior directed vector force of the deltoid muscle group, this situation may result in potential shoulder injury as the athlete continues to participate in athletic performance training, team practice, and athletic competition.

My associates and I have also made an interesting observation in our Sports Physical Therapy practice. Through the many years of rehabilitating numerous post-operative shoulder athletes, when speaking with the orthopedic surgeons who performed these shoulder procedures, comments have been made regarding which of these surgical cases had "pristine" gleno-humeral joints and in which cases the presence of some stage of gleno-humeral arthritis was was observed. It appears that those athletes who emphasize the use of Olympic style lifts (including a post-op Olympic Weightlifting two time Gold Medalist who traveled to the U.S. for surgery and rehab) and/or standing overhead lifts as part of their performance training, more often than not, demonstrated the "pristine" gleno-humeral joints of the shoulder. Comparing these surgical cases to the surgical cases of those who perform their strength training primarily with the use of a bench or back platform, more often than not, the latter group had the observation of some stage of arthritis at the gleno-humeral joint of the shoulder. Though I personally have not seen any research specific to these observations, empirically I am of the opinion that the absence of an external back platform allows for both "normal and efficient" shoulder kinematics as well as "optimal" muscle contribution to an overhead exercise, thus placing less abnormal stress on the joint surfaces during the repetitive overhead exercise performance.

4. Perform all overhead lifts in the plane of the scapula

The plane of the scapula (POS) is the normal "functional" plane of the shoulder. The POS is described as a position 30 to 40-45 degrees anterior to the coronal plane of the body. The POS allows for optimal humeral head contact in the glenoid as well as appropriate gleno-humeral/scapula-thoracic position, allowing for optimal muscle tension/function and movement rhythm, as the upper extremity strength overhead exercise is performed.

5. Avoid the behind the neck press

The performance of the behind the neck press will occur in the coronal plane of the body. This plane is not the normal "functional" plane of the body, nor does this plane allow for the optimal length tension of the scapula and rotator cuff musculature. Having less than optimal length tension, rotator cuff muscles, including the infraspinatus and subscapularis may be limited in their ability to assist in depressing the humeral head, a task necessary for centering the head in the glenoid during overhead arm ROM. One important function of the rotator cuff is to resist the superior migration of the humeral head in the glenoid due to the strong superior vector force of the deltoids, to ensure safe exercise performance. Abnormal superior migration of the humeral head may place the rotator cuff at risk of injury.

The behind the neck press also positions the shoulder in extreme external rotation under high loads, thus placing increased stress to the anterior structures and capsule of the shoulder, a scenario that is preferably avoided.

One exception where the behind the neck press exercises may be utilized is during the training of competitive Olympic style weightlifters. These athletes must assume a behind the neck position with the bar when catching and completing the snatch style lift with heavy loads. Thus the training lifts often require the use of behind the neck activities (i.e. behind the neck snatch jerks, snatch balance, etc…) to ensure both lift and competitive success. When appropriate limit the "depth" of the bar to the base of the skull, avoiding bar placement on the shoulders.

6. The exercise concludes with the athlete's arm directly vertical in line with their ear.

During the performance of overhead strength training, especially in younger athletes, the conclusion of the overhead lift may occur with the straight arm and hand in a position anterior or posterior to the head. A bar position that concludes either in front or behind the head requires additional strength and stability of the shoulder musculature as this arm/hand position results in an increased stress to the shoulder. A vertical alignment of the arm with the ear at the conclusion of an overhead lift is a safer, reduced stressed position for the shoulder vs. an ending position anterior or posterior to the head.

7. Avoid Gleno-Humeral Internal Rotation Deficit (G.I.R.D)

G.I.R.D. or Gleno-Humeral Internal Rotation Deficit is a loss of dominate shoulder internal rotation (IR) at the gleno-humeral joint when comparing dominate vs. the non-dominate shoulders. This loss of shoulder IR range of motion (ROM) is quite common in the dominate shoulder of throwers as well as in those participating in racquet sports and overhead athletics. These athletes demonstrate an increase in shoulder external rotation (ER), which is necessary for optimal ball and racquet velocity, with an associated decrease of shoulder IR at a position of 90 degrees of shoulder abduction (ABD). This loss of shoulder IR ROM creates a condition of posterior shoulder capsular ligament tightness which has been described as a source of abnormal gleno-humeral mechanics during throwing/racquet/overhead activities. The hypothesized causes of this G.I.R.D. phenomenon are beyond the scope of this discussion. However athletes with the presence of G.I.R.D may be at risk of rotator cuff and/or labral pathology.

It is important to note that the risk of injury due to the presence G.I.R.D is directly correlated to the differences of dominant vs. non-dominant shoulder IR in conjunction with the difference of total shoulder ROM (ER+IR). The greater the measured shoulder ROM deficits, the increased risk of potential shoulder pathology. Some time ago in a dinner conversation with my friend physical therapist Kevin Wilk, he stated that he and his associate Mike Reinold made an important observation regarding G.I.R.D. In a 5 year study of pitchers from 2 different Major League Baseball teams, they concluded that pitchers with an 18 degree or greater differential loss of IR (G.I.R.D.), in association with a differential in total shoulder ROM loss of greater than 7 degrees, have a 4.5 times greater likelihood of being placed on the disabled list during the baseball season. Kevin also expressed his opinion that any measured G.I.R.D. in association with any measured total shoulder IR/ER ROM deficit still places the athlete at risk of injury. The greater the differences, the greater the potiential risk. It is recommended that the athlete eliminate all ROM deficits by maintaining shoulder flexibility for optimal exercise performance with minimal risk of potential injury.

8. Exercise Program Volume

My experience as a physical therapist, athletic trainer, and strength and conditioning coach has established my concern with regard to exercise volume. This is not to say I ignore exercise intensity or the selection of the specific exercises to be performed, but with all else being equal, it is the exercise volume, and more specifically excessive exercise volume, causing fatigue, that in my opinion, is usually the predecessor to potential performance training shoulder injuries.

Various studies have described the effect of fatigue on shoulder kinematics, including the changes that occur at the gleno-humeral joint during activities such as baseball pitching, basketball shooting, strength training, and even raising a fatigued arm overhead, to name a few. These changes in shoulder kinematics place the athlete at possible risk of injury. This "fatigue" scenario is also present during the overhead training of the shoulder when inappropriate excessive exercise volume is prescribed.

Final Thoughts

The past decades concern with the danger of overhead strength training is analogous to the danger of squat exercise in the 1960's and 1970's. Hopefully over time, with the utilization of the proper guidelines for the application of overhead strength training, the medical and athletic performance community, coaches, and athletes themselves will one day consent to the use of the overhead strength training. Hopefully, these exercises will follow the same path of comfort and acceptance in the same way the squat and other lower extremity closed kinetic chain exercises are recognized and accepted today.

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