

A Sport-specific Performance and Prevention Program for the Throwing Quarterback

Mark S. Kovacs, PhD, CSCS*D^{1,2} and Thomas Katzfey, BS¹

¹Sport Health Science Department, Life University, Marietta, Georgia; and ²International Tennis Performance Association, Atlanta, Georgia

ABSTRACT

TRAINING THE FOOTBALL QUARTERBACK (QB) REQUIRES A UNIQUE UNDERSTANDING OF THE BIOMECHANICS OF THE MOTION INVOLVED AND THE NEED TO TRAIN THE INDIVIDUAL TO PERFORM THE MOVEMENTS NECESSARY TO MOVE EFFICIENTLY, POSITION THE LIMBS EFFECTIVELY, AND LOAD THE KINETIC CHAIN SUCCESSFULLY. ALL OF THIS NEEDS TO OCCUR WITHIN A MINIMAL TIME PERIOD UNDER SIGNIFICANT TIME PRESSURE AND A CHANGING DEFENSE. HAVING A STRUCTURED, QB-SPECIFIC, PROGRAM CAN AID IN THIS DEVELOPMENT BY CREATING AND IMPLEMENTING A TRAINING PROGRAM TO FOCUS ON THE SPECIFIC NEEDS OF THE ATHLETE WITHIN THE LARGER TEAM-BASED STRENGTH AND CONDITIONING PROGRAM.

INTRODUCTION

Training the football quarterback (QB) requires a unique understanding of the biomechanics of the motion involved and the need to train the individual to perform the movements necessary to move efficiently, position the limbs effectively,

and load the kinetic chain successfully. Also, having a clear understanding of the offensive philosophy of the coaching staff/team will also be important in designing a QB-specific program that is most appropriate for each individual. One of the major aspects of training the QB from the physical perspective is to train the athlete to store potential energy and subsequently release this energy to execute a powerful and successful throwing motion. All of this needs to occur within a minimal time period under significant time pressure (because of the defensive players attempting to tackle or pressure the QB) and ever changing defensive schemes. Being a QB at all levels of football (age-based levels, high school, collegiate, or professional) is a challenging position because of the factors mentioned above. However, having a structured QB-specific program can aid in the development of the athlete and help them perform on the field by creating and implementing a training program to focus on the specific needs of the athlete within the larger team-based strength and conditioning program. These QB-focused drills and progressions need to not only focus on optimizing the athlete's performance but also focus on reducing the chance of injuries associated with poor

neuromuscular control as well as the potential for overuse and musculoskeletal maladaptations seen in the repeated environment of throwing (1,2). The objective of a QB-specific training program needs to be focused on how to make the QB a better football player for success on the field, not just better in the weight room. Many implements, training devices, and weighted/unweighted tools may be used to train the QB, but to successfully design a QB-centric program, it is important for a strength and conditioning professional to have a basic understanding of the QB throwing motion. Although many models exist highlighting the different stages of the throwing motion, one of the most often used in the scientific literature is the 4-phase model that is typically described as (a) early cocking, (b) late cocking, (c) acceleration and (d) follow-through (3):

- The early cocking phase is initiated at rear foot plant and continues to maximal shoulder abduction and internal rotation. Greatest maximal voluntary isometric contraction (MVIC) activity is seen in the infraspinatus (46%) and supraspinatus (45%) muscles (3).

KEY WORDS:

NFL; American football; passing

Performance and Prevention Program for Quarterbacks



Figure 1. Football quarterback throwing motion.

- The late cocking phase starts at maximal shoulder abduction and internal rotation and ends at maximal shoulder external rotation. There is increased global muscle activity except in the middle deltoid. The MVIC activity in the infraspinatus (69%) and supraspinatus (65%) are highest overall (3).
- The acceleration phase begins at maximal shoulder external rotation and ends with ball release. Overall, there is global increased activation. The highest MVIC is seen in the

pectoralis major (86%) and subscapularis (81%).

- The follow-through phase is defined from ball release to maximal horizontal adduction (across the body). There is increased MVIC of the infraspinatus (86%) and supraspinatus (87%) to join the pectoralis major (79%) and subscapularis (95%) in high levels of activity.

When throwing overhead, there is a proximal to distal sequencing supplied by the kinetic chain (4,5). This sequencing is a vital aspect for both

performance and injury prevention. Training the athlete to effectively transfer energy from the ground up through the entire kinetic in the most efficient manner is an area that is typically left to the skills coach. However, appropriate strength and conditioning programs can aid in the overall development of the athlete and play an important role. Alterations in this sequential motion could result in decreases not only in ball velocity but also in increased injury potential (4–6). It is important to

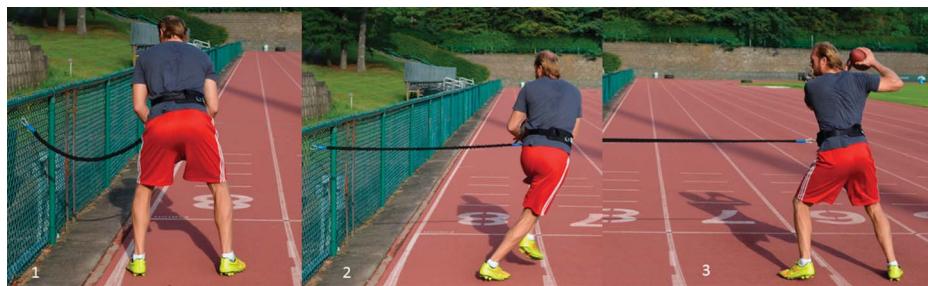


Figure 2. Quarterback first step drill with resistance.



Figure 3. Quarterback first step loading drill with Thera-Band.

remember that a football weighs between 14 and 15 oz (which has been the same weight since 1912) (7) and is significantly heavier than a baseball (5 and $5\frac{1}{4}$ oz) or even a tennis racket (weight varies from 7 to 12 oz). This results in different mechanical needs of the body to effectively throw the football. As a result, specific training for football needs some different movements/exercises than are used in other overhead sports. Although the football throwing motion has some similarities with other overhead throwing activities (baseball pitching, tennis serving, volleyball spiking, etc.), many differences do exist in the biomechanics of the entire kinetic chain (8). Some of these differences include the different lower-body loading mechanics, the different external and internal rotation ranges of motion at the hip, shoulder, and elbow, and also the contact points/release points of the different movements. See Figure 1 for a visual

description of the football throw and the different aspects of the motion.

WHEN TO IMPLEMENT PROGRAMMING

Knowing when and how to implement a performance and prevention program for a football QB is an important part of being a successful coach. Although QB-specific programming is relevant at all levels of the game, it is important to understand when athletes may make the biggest improvements in motor skill development, strength, power, flexibility, and endurance. For example, in the collegiate football environment, QBs show the greatest improvement in performance parameters (i.e., body mass, % body fat, % lean body mass, proagility test, 40-yd sprint, bench press, chin-ups, vertical jump, and power index) during the first year in the collegiate setting (i.e., freshman or redshirt freshman) (9). Results during years 2–4 are varied in improvement (9). This type of data is important for collegiate strength and

conditioning coaches to understand and implement a QB-specific set of exercises during an athlete's first year on campus to attempt to make the biggest improvement. Although this is an example in the collegiate setting, similar data exist for early age groups (high school, middle school, etc.). As this



Figure 4. Single-leg stability pad 1/4 squat quarterback drill.



Figure 5. 90°/90° shoulder tubing isolation with Flexbar perturbations.

article is not specifically focused on growth and development in athletes, the following sources provide a more extensive review (10–12).

FIRST STEP MOVEMENT

Most QBs are taught to drop back 3 or 5 steps to pass (7). The first movement backward from the snap is an important aspect of the QB's ability to create time in the pocket, and the ability to effectively and efficiently perform this first movement requires specific training. All ground-based power movements (i.e., power cleans, power snatches, explosive jumps, etc.) are important and should be performed because of the linkage with the QB throw and the need for the athlete to effectively use the ground during each throwing motion; however, a major

focus needs to be on the first step in this movement. The QB First Step Drill With Resistance is an exercise that is specifically designed to aid the QB in this movement (Figure 2). This movement involves a resistance band or bungee secured to a stable anchor at torso level. The belt attached to the band/bungee is then secured around the athlete's waist. The athlete then sets up like he would to receive the snap from the center (this could also be done with someone handing the QB the ball to recreate the snap sequence). On a visual signal, the athlete will explosively push against the resistance working on good lower-body mechanics.

Another important aspect of the first step in the QB throwing motion is the ability for the athlete to transition from

the "under center" position and drop back into the pocket to appropriately position the body for either a hand-off to the running back or to reposition the body to be able to effectively throw the ball down the field. To work on the movement, the QB First Step Loading Drill With Elastic Tubing is a beneficial exercise to work on explosively transitioning the body from a low position to a more upright position with slight rotation (Figure 3). This exercise is performed with the tubing connected at a low anchor position in line with the front foot of the athlete. From this low position, the athlete explosively pushes backward with hip rotation and elevation. The purpose of the drill is to move as quickly as possible against the resistance and go from a low body position and an anterior lean position into an

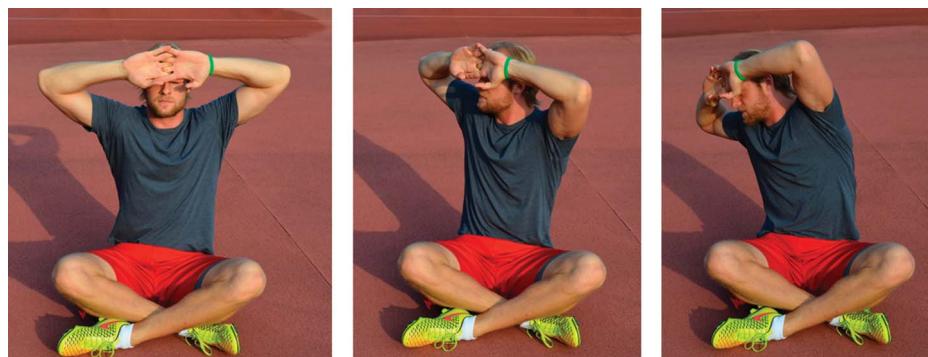


Figure 6. Seated hourglass—seated thoracic rotation with lateral flexion.



Figure 7. Pretzel thoracic rotation.

upright position, mimicking the motion that is required to move the body into a throwing position.

FINAL STEP MOVEMENT

Just as important as the first step in the QB movement is also the final step during the drop back movement sequence, followed by the next step forward to help position the feet directly under the hips (Football U. QB Throwing. <http://usafootball.com/help/qb-footwork> [serial on the Internet]. 2014: Available from: <http://usafootball.com/help/qb-footwork>). To develop this movement, the athlete should perform the Single-Leg Stability Pad $\frac{1}{4}$ Squat QB Drill (Figure 4). This movement is a QB-specific movement that works on hip and core control while the athlete is

positioning themselves in the early arm cocking stage of the throwing motion. The goal of this exercise is accomplished through synchronous single-leg and transverse plane movement that improves proprioception and muscle education (2). Having appropriate stability during this stage is vital to be able to throw effectively. The resistance tubing is anchored in front and to the side of the athlete. The athlete grasps the tubing and then positions their back leg (right leg in a right-handed thrower) on the stability pad. From this position, the athlete performs a quarter squat movement while keeping tension on the resistance tubing and having a strong early arm cocking stage position of the upper body while maintaining good

core and hip control during each repetition (Figure 4).

SHOULDER EXERCISES

Shoulder injuries are one of the most common injuries in football QBs (6). Many coaches instruct QBs to perform a structured throwers program and in many programs this is very similar to the prehabilitation or injury prevention programs that are used with other overhead sports (baseball pitchers, volleyball, and tennis). However, one area that does separate football QBs compared with some other overhead sports is the potential for the QB to be hit or bumped during the throwing motion. Although this does not happen regularly, it is one aspect of the throwing motion that needs to be trained. One good exercise to work on stability of the shoulder region is the $90^\circ/90^\circ$ Shoulder Tubing Isolation with Flex-Bar Perturbation (Figure 5). This exercise is focused on strengthening the smaller muscles of the rotator cuff along with the scapula stabilizers. The athlete attaches the tubing against an anchor position in front of them about torso or chest level. From this position, the athlete grasps the handle of the tubing while simultaneously grasping the end of a Thera-Band Flexbar (The Hygenic Corporation, Akron, OH). The athlete then positions the shoulder at 90° abduction and 90° external rotation. The perturbations provided by the manual oscillation of the Flexbar

Table
Sample 3 days a week QB performance and prevention program

Exercise	Repetitions	Sets
QB first step drill with resistance (Figure 2)	8	3
QB first step loading drill with elastic tubing (Figure 3)	12	3
Single-leg stability pad $\frac{1}{4}$ squat QB drill (Figure 4)	10	3
$90^\circ/90^\circ$ shoulder tubing isolation with Flexbar perturbations (Figure 5)	30 s	4
Seated hourglass—seated thoracic rotation with lateral flexion (Figure 6)	5	3
Pretzel thoracic rotation (Figure 7)	5	3

QB = quarterback.

provide a dynamic reactive instrument that provides oscillatory resistance proportional to the force applied to it and the speed of oscillation. This requires the glenohumeral joint and surrounding muscles to stabilize under a varied external load. This type of stabilization may be needed during game situation if a QB is hit/bumped while throwing.

QUARTERBACK-SPECIFIC RANGE OF MOTION

Although strength and power are vital to be a successful high-level QB, having the necessary range of motion is an area that is sometimes overlooked. The QB throwing motion is a multiplanar movement through multiple degrees of freedom. The following 2 range of motion exercises are relevant to the movement and positions that the QB uses on every throw. The Seated Hourglass is a movement that involves thoracic rotation with lateral flexion (Figure 6). The athlete sits crossed legged with the back of the hands on his forehead and elbows out to the side above shoulder height. The objective is to maintain a tall upper-body position while rotating to the right as far as possible. Once the end range is reached, perform a slight right lateral flexion movement and hold for 2 seconds at this end range. Return from the right lateral flexion movement and continue to increase the range of motion through lateral flexion. Repeating this process 5 times is considered 1 set.

The Pretzel Thoracic Rotation exercise is another range of motion exercise relevant to the QB. This exercise involves the athlete sitting crossed legged with the right hand on the back of the head on the right side of the body and the elbow out to the side above shoulder height. From this starting

position, the athlete rotates to his right through thoracic rotation (Figure 7) as far as possible while maintaining a tall posture. Perform 5 repetitions of this movement.

The exercises provided are a sport-specific series of movements specifically designed for the QB. The Table provides a sample workout for QBs that can be performed 3 days per week as part of the overall strength and conditioning program.

Conflicts of Interest and Source of Funding:
The authors report no conflicts of interest and no source of funding.



Mark Kovacs is the Director of the Life Sport Science Institute and Associate Professor in the Sport Health Science Department at Life University.



Thomas Katzfey is a graduate student in the Department of Sport Health Science at Life University.

REFERENCES

- Burkhart SS, Morgan CD, and Kibler WB. The disabled throwing shoulder: Spectrum of pathology part 1: Pathoanatomy and biomechanics. *Arthroscopy* 19: 404–420, 2003.
- Fleisig GS, Escamilla RF, Andrews JR, Matsuo T, Satterwhite Y, and Barrentine S. Kinematic and kinetic comparison between baseball pitching and football passing. *J Appl Biomech* 12: 207–224, 1996.
- Harries SK, Lubans DR, and Callister R. Resistance training to improve power and sports performance in adolescent athletes: A systematic review and meta-analysis. *J Sci Med Sport* 15: 532–540, 2012.
- Hirashima M, Yamane K, Nakamura Y, and Ohtsuki T. Kinetic chain of overarm throwing in terms of joint rotations revealed by induced acceleration analysis. *J Biomech* 41: 2874–2883, 2008.
- Johnston RB III, Howard ME, Cawley PW, and Losse GM. Effect of lower extremity muscular fatigue on motor control performance. *Med Sci Sports Exerc* 30: 1703–1707, 1998.
- Kelly BT, Backus SI, Warren RF, and Williams RJ. Electromyographic analysis and phase definition of the overhead football throw. *Am J Sports Med* 30: 837–844, 2002.
- Kelly BT, Barnes RP, Powell JW, and Warren RF. Shoulder injuries to quarterbacks in the national football league. *Am J Sports Med* 32: 328–331, 2004.
- Kibler WB, Kuhn JE, Will K, Sciascia A, Moore S, Laudner K, Ellenbecker T, Thigpen C, and Uhl T. The disabled throwing shoulder—Spectrum of pathology: 10 year update. *Arthroscopy* 29: 141–161, 2013.
- Malina RM. Top 10 research questions related to growth and maturation relevance to physical activity, performance, and fitness. *Res Q Exerc Sport* 85: 157–173, 2014.
- Malina RM and Rogol AD. Sport training and the growth and pubertal maturation of young athletes. *Pediatr Endocrinol Rev* 9: 441–455, 2011.
- Riffenburgh B. *The Official NFL Encyclopedia*. New York, NY: HarperCollins, 1997.
- Stodden D and Galitski HM. Longitudinal effects of a collegiate strength and conditioning in American football. *J Strength Cond Res* 24: 2300–2308, 2010.