

The Goalkeeper's Shoulder

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Dr. Win Chang, Founder of ShoulderSphere

The Problem



Catlike reflexes, arm stretched out flying through the air as Superman, these are the qualities that set goalkeepers apart from rest of the team.

Being the most important last man standing between the ball and the goal line, the keeper must execute by whatever means to prevent the ball from entering the goal. Diving, punching, catching, kicking are just some of the basic skills needed by any keeper.

Because keepers are given specialized positions and responsibilities in the game, they have significantly less demanding tasks of running as compared to the rest of the team. Consequently they are less prone to injuries in the knee or the ankle such as sprains, torn cartilage, or torn anterior cruciate ligament. In exchange, keepers are at higher risk of shoulder injuries secondary to their unique activities, being the only position allowed to use their hands and arms to block and catch the ball during play. One additional skill the keeper must be able to perform with precision is to be able to throw the 15 oz ball at least 40 yards, much like a baseball outfielder.

Diagnoses such as “biceps tendinitis”, “shoulder impingement”, “bursitis”, “rotator cuff tendinitis”, “labral tear”, “SLAP tear”, “hyperlaxity”, “instability”, and “rotator cuff tear” are unique to goalkeepers more so than rest of the players.

Functional Shoulder Anatomy

The shoulder, being the most mobile joint in the body, endows our ability to place our hands virtually anywhere in space. In exchange for this evolutionary trait of nearly unrestricted arm motion, by default, comes with increased shoulder instability.

The single most important structure that keeps the shoulder joint stable is the rotator cuff. The rotator cuff is consisted of four separate muscles, one from the front of the shoulder, three from the back of the shoulder. Although four muscles, from four locations, they converge together on top of the arm bone (humeral head) and function essentially as *one muscle acting in unison*. The simultaneous contraction of these four muscles *compress* the humeral head and essentially lock the arm bone against that part of the shoulder blade bone called the glenoid. This is called “glenohumeral joint compression”, or “centration” effect — the joint is compressed in a centered position. Any relative weakness in one of the rotator cuff muscles will lead to off-centered movement of the humeral head during shoulder motion. When repeated many times, this will lead to shoulder pain, tendinitis, labral tears, and ultimately even rotator cuff tears.

In order to ensure shoulder stability, all four muscles must contract synergistically in a balanced manner, with just the right amount of tension from each muscle, to keep the humeral head centered and compressed against the glenoid, while at the same time be flexible and yield to changing directions of shoulder movement.

Functionally, the rotator cuff muscles facilitate 3 aspects of shoulder activity — 1) changing directional movements of the shoulder 2) arm acceleration, and 3) arm deceleration.

The Challenge Faced By Goalkeepers

Guts, grits, and graceful reflexes are key ingredients for keepers who hold clean sheets. Highly entertaining for spectators, but their Superhuman moves can be quite risky. The

penalty-kick shootout may be one of the most intense and nerve-wracking moments in a football match.

Accounting for arm thrusting velocity to block or catch the oncoming penalty kick of a 15 oz ball traveling at speeds up to 80 mph from 12 yards away, the angular momentum subjected by the shoulder with directional changes in acceleration and deceleration, the rotator cuff may be subjected to forces 3 to 4 times body weight in under 1/2 second. This translates to a rotator cuff power equivalent of greater than 2,500 ft-lb per second to keep the shoulder stable for a 150 lb goalie's arm thrusting a distance of 3 feet in under 1/2 second.

Throwing the 15 oz ball is no less challenging. Baseball pitchers throw a 5 oz ball a distance of 20 yards; while the superb keepers can throw the 15 oz ball 40 yards. This really means that any high performance keeper can pretty much be able to throw a baseball at least 90 mph! Fortunately, throwing the ball by keepers is not as frequency intensive as a Major League baseball pitcher. However, the stress imparted onto the rotator cuff by the keeper's throwing shoulder is no less demanding than the baseball pitcher's pitching shoulder.

The ability to throw is predicated on a stable shoulder joint. Like the tires on a Formula 1 race car that keep the car on the track, your rotator cuff keeps your shoulder centered in the joint.

What makes the rotator cuff exceptionally prone to injury is not just the power required, but the rapid adjustments needed to respond to changes in the directions of shoulder movement. Within milliseconds, the tendons must adjust to directional changes and stay engaged while the arm whips across sagittal, coronal, and transverse planes of motion. Ineffective and, or, inefficient rotator cuff engagement are direct causes for shoulder instability, shoulder underperformance, shoulder pain, and shoulder injury.

SLAP Tears - A Unique Proposition

An entity unique to all shoulder athletes is the SLAP tear. SLAP stands for Superior *Labrum Anterior and Posterior* tear. It is a detachment of the top part of the fibrocartilaginous rim from the shoulder socket (glenoid) where the biceps tendon attaches. Tears can occur from 1) a direct fall onto an outstretched arm, 2) repetitive overhead activity with inadequate shoulder stability, or 3) reflexive biceps muscle eccentric contraction creating tensile stress on the biceps anchor in an unstable shoulder. All keepers are at risk due to the forceful distracting nature of repetitive thrusting arm motions.

The principal cause for shoulder pain and SLAP tear is a weak rotator cuff. A shoulder during motion, especially at *end ranges* of motion — such as when the arm is maximally thrust to the side or maximally raised upwards blocking a high ball, is stressed at risk of slippage to either

dislocate or detach the labrum, if it were not for the centration effect created by the rotator cuff.

How To Prevent Goalkeeper Shoulder Injuries

The cornerstone for all shoulder injury prevention programs is to strengthen the rotator cuff. Traditionally these have involved pulling elastic bands or lifting dumbbells. However, more important than to “strengthen” the four rotator cuff muscles, is to “train” how the four muscles *function in unison* to effect the desired movement. Therein lies the difference between “strengthening” and “training”. Strengthening gets the muscle strong; training gets the muscle functional for a specific activity.

Shoulder injuries among well conditioned athletes are essentially secondary to poor “motor control”, *not* motor weakness”. Elastic bands and weights do “strengthen” the rotator cuff muscles; however they do not “train” for function of the activity across multiple planes of motion, such as moving the arm to the side followed by swinging upward. When the shoulder moves through multiple planes of motion, each rotator cuff tendon must be responsive to changes in shoulder direction, shoulder acceleration, and shoulder deceleration. Shoulder joint stability throughout all ranges of shoulder motion can only be achieved by coordinated synergistic activation of all four rotator cuff muscles, just like a well orchestrated symphony, working together as *one functional muscle unit*. This “one” functional equivalent muscle unit exerts a constant and well balanced glenohumeral joint compression force through all planes of motions in order to ensure shoulder joint stability throughout all planes of motion and to avoid shoulder injury.

The ShoulderSphere Technique

Rather than pulling rubber bands or lifting dumbbells in a “linearly” directed fashion in one of four “directionally” based movements - the push, pull, lift, or the press; ShoulderSphere (Figure 1) is the only rotator cuff exercise device in the world that strengthens and trains ALL four of the rotator cuff muscles simultaneously in a rotational manner. Linear movements only work on one muscle, one plane, and one direction at a time. These are nonfunctional and may result in imbalanced strengthening.

The use of ShoulderSphere involves active rotation of the ball inside the globe of the ShoulderSphere. When rotating the ball inside the globe in a circular motion, all surrounding muscles must work in a synchronized and balanced fashion in unison in order to make this circular motion. Any rotator cuff shut down or imbalance will cause the ball inside the globe to drop and bounce rather than to rotate, which provides an immediate biofeedback to the user’s rotator cuff engagement. Additionally, when using the ShoulderSphere, the user’s wrist is locked in the splint by the strap, all the work needed to rotate the ball must all come from the four rotator cuff muscles. The elbow only goes up and down. The wrist, being locked, cannot compensate to rotate the ball.

Therefore, all the rotation must come from the rotator cuff.... the rotator cuff *rotates*. These features make ShoulderSphere a most unique rotator cuff exercise device which provides the most selectively isolated rotator cuff workout of any technique available.

Figure 1



The Electronic Power Tracker

A special feature of ShoulderSphere is the attached electronic power tracker (the blue box in Figure 1). This electronic tracker gives real-time display of the power of rotator cuff muscles during workouts. Power is equal to arm velocity. Green light equates to low power for endurance workout, red light equates to high power workout for high intensity interval training style exercises (HIIT).

The power tracker is activated by active spinning of the ball inside the ShoulderSphere. The DIRECTION of spin does not matter. Since this is “circular” training, as long as the ball spins, ALL rotator cuff muscles are engaged. The principle of ShoulderSphere workout is to maintain a continuous smooth spin of the ball inside the ShoulderSphere throughout the entire training session. Avoid allowing the ball to bounce, which signifies one or more of the rotator cuff muscles has been shut down, thus the chain of the circle has been broken.

THE POWER TRACKING LIGHT—

Fast spinning makes the power light turn on in red, lower power velocity spin changes it to green. A test, and means of tracking one's progress with power improvement, is one's ability to maintain the tracker lit in red for 30-60 seconds continuously. This is high intensity interval training. Fun gauge regarding one's own progress. GREEN light can be thought of as endurance training; RED light as power training. Activity translational equivalents can be thought of as that when the power tracker light is maintained in red for 3 second while using the larger ShoulderSphere (A7 model), it is equivalent to the rotator cuff engagement required for an arm velocity of 90 mph movement; when the light is lit in green, it is equivalent to the rotator cuff engagement for an arm velocity of 60 mph movement.

Strengthening vs Training

ShoulderSphere can be used either as a pure rotator cuff strengthening device (in “static mode”), or as a training device (in “dynamic mode”). “Static mode” technique to strengthen the rotator cuff is performed by active rotation of the ball inside the globe without concurrent arm motion. “Dynamic mode” training technique is performed by moving the arm through various planes of motion while at the same time rotating the ball inside the globe (which actually also strengthens the rotator cuff muscles at the same time). Dynamic mode specifically trains the responsiveness of the rotator cuff muscles to adjust to the changing directions of multiplanar shoulder movements. All four rotator cuff muscles are trained to function as *one muscle unit*, not separately as four, to maintain glenohumeral joint compression at all times. This trains motor control and constant rotator cuff engagement for those ranges of motion.

The following video depict “Static mode” training - <https://youtu.be/eT8s1yrWedg>

“Dynamic mode” training - for motor pattern simulation training, as in this “power-5” movement pattern anticipating various positions the goalkeeper's arm has to dynamically respond to — https://youtu.be/Q_sOsUCLg_s

Training the Rotator Cuff For Goalkeeper's Shoulder Movements

Shoulder injuries in goalkeeping occur when there is motion involved in the shoulder with rapid positional changes. “Strength” is how strong you are in one plane; “control” is how you well can move your arm through multiple planes. To be truly functional is the ability to adjust and maintain stability of the shoulder in a multidirectional manner when the arm is rapidly moving through changes in planes of motion.

The ShoulderSphere technique specifically builds rotator cuff power with training for control. This is performed by mimicking event-specific movements of the arm that mirror the goalkeeper’s motor patterns involved. This “dynamic” motor control workout calls for active rotation of the ball inside the ShoulderSphere globe while the arm mimicks the motor pattern anticipated by the keeper. The more realistic and the closer the mimicked motion that mirrors the activity intended, the more powerful will be the motor control training for rotator cuff responsiveness to stabilize the shoulder for that intend activity.

ShoulderSphere is the most efficient and effective rotator cuff training device you will ever need. It is also hands down the toughest rotator cuff exercise you will love.

There is a link on the website www.ShoulderSphere.com for a 10-week progressive rotator cuff strengthening program for goalkeepers, under “Workouts By Sport”.

To learn more about ShoulderSphere and how you can integrate various strengthening and training techniques to suit your needs, please visit www.ShoulderSphere.com and follow us on Instagram or Twitter @ShoulderSphere.

Dr. Chang is available for any questions or suggestions at Win@ShoulderSphere.com.