5

PLYOCARE BALL THROWING:
Building Positive Throwing Patterns

The most efficient way to remap parts of a pitching delivery is to use overloaded implements to provide better kinesthetic awareness throughout the throwing motion. There are two primary benefits of using constraint training with overload throws:

- *Developing sport-specific speed-strength by having physiological stimuli drive adaptations*
- *Reorganizing mechanical patterns through self-discovery with modification*

PlyoCare balls were designed for these purposes and for withstanding repeated high-intensity throws into hard surfaces, such as concrete walls and heavy mats. These soft-covered, sand-filled balls serve multiple purposes in our throwing programs, which makes them versatile and important tools. When throwing PlyoCare balls, establish a perceived throwing-target level around mid-chest to eye level, an external cue that can help optimize the brain's ability to correctly self-organize the body's throwing patterns.

By constantly testing and retesting the most efficient throwing patterns with the PlyoCare balls, we are able to provide a list of extremely effective drills that provide positive-mechanical feedback for a pitcher, as well as maximize the ability to produce

and accept force. Our PlyoCare drills are categorized into standard and specialized drills. Our standard PlyoCare drills are designed to cover the majority of common throwing-pattern deficiencies that we see in athletes, making up the bulk of an athlete's throwing workload each day. Specialized PlyoCare drills are designed to correct more specific throwing-pattern deficiencies that the standard PlyoCare drills may not target enough, and they are used in our Specialized Movement Focus throwing programs.

This chapter provides an overview and covers the proper execution of each PlyoCare drill that exists to date. For some of the more technical drills, the techniques will be broken down into beginner, intermediate, and advanced levels. Here's a breakdown of how we perceive each level:

BEGINNER LEVEL

The expected technique for a first-time athlete. This level of performance is mildly acceptable for the time being, but it needs to advance in order for a better quality of training.

INTERMEDIATE LEVEL

An acceptable level of performance. Some athletes might never advance out of this category, which is fine. Performing drills at this level is sufficient enough to self-organize throwing patterns in a positive manner.

ADVANCED LEVEL

An elite level of performance, and a clear goal to shoot for. Most athletes that fall into this category are professional or high-level college athletes that combine very good general movement quality with great understanding of the drill.

Reverse Throws

CLASSIFICATION
Overload Standard PlyoCare Drill

DRILL PURPOSE
Reverse throws are designed to train the posterior shoulder by activating the muscle group during the initial stages of the trunk counter-rotation, as well as providing an active stretch of the anterior shoulder muscle group during the follow through. Backwards chaining principles are also featured during this movement due to the focus on mastering thoracic-spine rotation during counter-rotation, which is an important component for high-velocity throws. Reverse Throws are also a good ballistic exercise that provides a strong psychological stimulus to not only provide power but also a conscious awareness of how an athlete's intent is focused on maximizing trunk-rotation speed in order to increase ball velocity.

COMMON MISTAKES
When executing Reverse Throws, there are three common mistakes to look out for when athletes first attempt this drill:

Starting Counter-Rotation from a Static Position
It's difficult to perform any explosive movement from a static position. Often, athletes will try to start their Reverse Throw from a still position with the ball on the ground. This makes it difficult to maximize speed and athleticism during the exercise. To correct this, we suggest having the athlete start in an upright position and then reach downward towards the ground to create some fluidity and tempo with the movement.

Collapsing the Lead Leg
During trunk counter-rotation, many athletes will let the lead foot roll over and the lead leg collapse, essentially causing them to mostly rotate at the hips. As stated before, one of the goals of the Reverse Throw is to rotate with the thoracic spine, which is trained less effectively when the lead foot rolls over. To correct this, keep the lead foot solidly planted on the ground while opening the chest to the throwing dominant side.

Lawnmower Pull/"Option Pass"
Sometimes at the point in time when athletes begin to make the first move to rotate and throw the ball, instead of making the initial move of starting the trunk's counter-rotation first, they begin to pull the ball towards the body by retracting the throwing-arm elbow, similar to starting a lawnmower. Once the trunk rotation has started, the athlete will then oftentimes push the palm of the hand at the wall, similar to throwing an option pass in football. This prevents the thrower from understanding the kinesthetic awareness of how the events of thoracic spine counter-rotation and a delayed throwing-arm maximize power and ball velocity. To correct this, help the athlete try to keep the throwing arm fixed to the shoulder as the trunk counter-rotation leads the movement and then drive the back of the hand at the wall.

EXECUTING THE REVERSE THROW

Beginner Level Method
A beginner-level Reverse Throw is what to expect from a first-time athlete. The first step is to kneel down on the throwing-side knee. An athlete that is able to execute a Reverse Throw at a beginner level is able to perform the movements of opening the chest towards the throwing dominant side and throwing the ball into the wall.

Intermediate Level Method
To build upon what the athlete learned at the beginner level, the ability to execute a Reverse Throw at an intermediate level is highlighted by performing the movements of opening the chest to the throwing-dominant side while simultaneously keeping the lead foot locked onto the ground. The athlete should keep the throwing arm fixed to the shoulder during trunk counter-rotation and drive the back of the hand at the wall. The throw should result in a ball flight that targets the wall right behind the athlete's head.

Advanced Level Method
The mark of an advanced-level Reverse Throw is what we view as executing the kinematics at a highly technical level with both speed and power. To optimize the starting position, kneel down on the throwing side with the lead leg straight in front at an approximately 100 to 115-degree angle, with the lead foot slightly internally rotated (much like the lead foot's positioning in a Rocker Throw). Once the starting position has been es-

tablished, the athlete should start in a gathered position with the trunk in a vertical position. Have the athlete reach towards the ground with the throwing arm at an up-tempo pace, and once the ball touches the ground, aggressively counter-rotate and drive the back of the hand towards the wall all while the lead foot maintains solid contact with the ground. There should be a slight amount of hip rotation, but the goal should be to maximize thoracic-spine mobility during the counter-rotation. Catch the ball off the wall, and proceed with the next rep at an up-tempo pace and repeat for the suggested amount of reps in the program.

Pivot-Pickoff Throws

CLASSIFICATION
Overload Standard PlyoCare Drill

DRILL PURPOSE
The most constrained, and also the most complex, drill to master, Pivot-Pickoff Throws are designed to accomplish several tasks. From a throwing-kinematics standpoint, this drill is designed to take out the lower half entirely in order to isolate the upper half in a position similar to its position at stride-foot contact during a pitch. This forces the athlete to learn how to properly create positive disconnection. Because we isolate the upper half and use much heavier implements than a baseball with this drill, it functions as a great modality to train the Elbow-Spiral and Driveline Phases as well. From an anatomical standpoint, Pivot-Pickoff Throws train internal-rotator and elbow-extensor strength, shoulder mobility, and forearm pronator-flexor dynamic strength. The upper half contains the most moving parts, so trying to execute this drill at an advanced level is an important focus for most athletes.

COMMON MISTAKES
Because Pivot-Pickoff Throws are the most complex drill out of all PlyoCare drills, there are a lot of mistakes that can occur, so you may need to refer to the Throwing Mechanics chapter to properly evaluate an athlete's technique. From our experience training athletes, here are a few common mistakes we see with this drill:

Throwing Breaking Pitches

Many athletes have poor awareness of forearm positioning, which can be exacerbated when throwing 1- and 2-kg balls. Sometimes athletes begin with too much supination in the throwing forearm, causing them to hold that position too long during the Driveline Phase, resulting in a curveball or cutter/slider spin axis. To correct this, make sure the athlete has the ball facing the same direction as the chest (neutral, right-hander towards third base, left-hander towards first base) at the moment when the forearm is vertical at the simulated stride-foot contact position, not when facing the athlete's head. Other times athletes just try to be a hero by grabbing the ball with two fingers, which often results in a slider spin axis. Unless an athlete has abnormally large hands and/or abnormally high grip strength, it's likely optimal to use three fingers when gripping a 1- or 2-kg ball. One internal cue that often helps correct this without disrupting an athlete's intent is "feel the ball come off the ring finger when it leaves the hand." In reality it won't actually come off the ring finger like a circle changeup, but this feel is usually an indicator that the athlete has turned his hand over in time during internal rotation.

Lack of Trunk Counter-Rotation

Athletes commonly keep their feet stuck in place instead of rotating them to allow the lead shoulder to close off. Throwing from a partially open position is better than nothing, but it only partially maps positive disconnection (see more in the Lack of Positive Disconnection section below) and the Driveline Phase. To correct this, two simple internal cues that often work to close off the trunk without disrupting an athlete's intent are to either "crank the throwing-side lat down to the back of the throwing-side hip" or "slightly elevate the lead shoulder at the target."

Pushing the Ball

Some athletes might push the ball a little bit at first, but don't be too quick to change their throwing-side mechanics, especially if they're performing most of these steps correctly. With that said, there are often two ways athletes push a ball, and knowing the difference is important. The first way is whether or not the athlete leads with the hand before the elbow, very much like in a shotput-type fashion. These athletes will often exhibit the same behavior on wrist weights as well, and internally cueing them to feel some layback by leading with the elbow isn't a bad idea.

However, some athletes actually perform the outlined steps correctly and simply don't generate much layback, which gets misinterpreted by many observers as pushing the ball. Sometimes it takes a little while for the athlete to trust the drill and/or weighted balls, and sometimes it can be due to a mobility constraint, so knowing their screening results is a key piece of information in these instances. Show patience with these types of athletes and allow the PlyoCare balls to do their job over time when possible.

Lack of Positive Disconnection

There are a few common reasons why athletes fail to create positive disconnection, and you actually have to check the throwing and glove sides to correctly identify the reason. On the glove side, the most common problem athletes encounter is pulling the glove arm at the same time as the trunk rotation. There are three common reasons for this issue:

1. *Reaching too far across the body with the glove arm, creating too far of a distance to travel*
2. *Keeping the glove-arm forearm too close to the body ("chicken wing"), not creating enough length to feel how to properly move the glove-arm elbow through space*
3. *Pulling the glove arm dependently of the lead shoulder, not independently of the lead shoulder*

An often-overlooked reason that athletes commonly lack ideal positive disconnection is because they don't create enough scap retraction on the throwing side, which often occurs due to a lack of trunk counter-rotation. Correcting positive-disconnection issues is usually the most difficult part of optimizing the Pivot-Pickoff Throw, so please reading the section below on how to properly execute this drill in order to learn how to correct this issue.

EXECUTING THE PIVOT-PICKOFF THROW

Beginner Level Method

If athletes have performed wrist weights before, then they'll understand the basic Pivot-Pickoff Throw stance. For those that have not read the wrist-weights section, the first step is for the athlete to establish the direction the throw will occur and then turn 90 degrees so that their throwing side faces the throwing direction. Right-handed throwers face 90 degrees to the left in order for their right side to face the throwing direction; left-handed throwers face 90 degrees to the right in order for their left side to face the throwing direction. After the athlete has determined which way to face, he should stand with the feet no wider than shoulder width, with his weight slightly over the balls of the feet to allow for rotation. Once this starting position is established, executing a typical beginner-level Pivot-Pickoff Throw means simply counter-rotating the torso and throwing the ball at the wall or target.

Intermediate Level Method

Once the basic Pivot-Pickoff Throw movement has been established at a beginner level, the goal for executing this drill at an intermediate level is primarily optimizing the throwing side and, secondarily, gaining some understanding of how to properly use the glove arm. The first step to this process is making sure the athlete achieves sufficient counter-rotation of the torso. Sufficient counter-rotation means that the athlete's lead shoulder is slightly elevated and pointing at the wall or target, and the throwing-side lat is cranked slightly down towards the back of the throwing-side hip. The goal behind this is to slot athletes into a pre-set position where they simulate being at max-scap retraction on their throwing side at stride-foot contact. After sufficient counter-rotation has been achieved, make sure the athlete's forearm is in a neutral position (ball facing same direction as the chest) and somewhat vertical. Next, the athlete should reach out towards the wall with the glove arm in a pronated position, like for wrist-weight Pivot-Pickoff Throws. After that, simply pull the glove arm and throw the ball. Check to make sure the PlyoCare ball's spin axis resembles that of a fastball, not a breaking ball. When the athlete gets comfortable with the Intermediate level movements, they should try to move as fluidly as possible at the prescribed RPE for the day.

Advanced Level Method

Performing Pivot-Pickoff Throws at an advanced level is an extremely technical movement where every small detail matters. With a technical movement comes a technical explanation, so let's assume the athlete is executing the steps of the intermediate-level method very well. The last layer to add is the targeted training of positive disconnection. To begin our explanation of this drill at an advanced level, let's start at the point where the athlete is at counter-rotation (lead shoulder elevated,

forearm neutral, glove arm extended towards the wall/target in a pronated manner, etc.). Before the athlete rotates to throw, the first move should be to supinate the glove hand and drive the glove-arm elbow towards the back of the lead hip. The athlete should attempt to delay trunk rotation as long as possible by keeping the lead shoulder closed while the elbow drives towards the back of the lead hip. Like referenced in the wrist-weights section, this movement should resemble that of a kneeling cable row. In other words, the glove arm should pull independently of the lead shoulder, not dependently of the lead shoulder. Once the glove arm starts to travel through space ahead of the initial trunk-rotation movement, the athlete should naturally unwind the trunk to throw the ball as outlined in the beginner- and intermediate-level sections.

Related note: If athletes need additional help with feeling the glove arm in space, placing a 450-g or 1-kg ball in their glove hand can improve proprioception. There's also nothing wrong with having athletes use their glove. However, placing anything heavier than a 1-kg ball in their glove hand (most commonly a 2-kg ball) is *not* recommended because many athletes are not strong enough to move that type of weight quickly enough, which can have an adverse effect on training correct glove-arm movement.

These steps are helpful to know how to perform the drill, but how do you truly know if an athlete has executed the Pivot-Pickoff Throw at an advanced level? There are a few signs to look for. First, as trunk rotation begins, you should notice that the athletes that create elite positive disconnection have an apparent lengthening in the chest ("big chest") due to the scap retraction created on both the glove and throwing sides. This should then cause trunk flexion towards the wall/target, creating a natural path to forwardly rotate the throwing shoulder during the Driveline Phase. This should cause a visual weight shift to the throwing side after the throw has been completed. Athletes that create poor positive disconnection tend to keep their weight centered between their feet throughout the throw, even moving away from the wall/target in some instances. We strongly suggest checking out our videos outlining Pivot-Pickoff Throws on our website to get a better visual in order to optimize how well you can apply this information to training your athletes.

Roll-In Throws

CLASSIFICATION
Overload Standard PlyoCare Drill

DRILL PURPOSE
If the Pivot-Pickoff Throw is designed to isolate the upper-half kinematics, then Roll-In Throws represent the next progression by adding a linear component. The drill minimizes the lower-half rotation component, keeping the task of drilling trunk stacking and lead-leg blocking, two of the most important variables to master for high-velocity throwing, as simple as possible. This drill is nowhere near as technical as the Pivot-Pickoff Throw, so athletes usually pick up on the technique quickly.

COMMON MISTAKES
While Roll-In Throws are less complex than Pivot-Pickoff Throws, there are two common, but easily correctable, mistakes that athletes make while attempting this drill:

Actively Planting Sideways

The most common mistake to watch out for is athletes' actively planting their bodies sideways (evident by planting the back foot sideways) when they are about to throw. Basically, an athlete should stay totally linear towards the wall in this drill. (See a full explanation in the "Executing the Roll-In Throw" section.) A good internal cue that helps fix this is to tell the athlete to "throw on a walk" and relate it to how middle infielders throw on the run.

Along these same lines, coaches and trainers often mistake two different events, actively planting the back foot sideways and back-foot counter-rotation after contact with the ground, as one flaw. To be completely clear, actively planting the back foot sideways before the throw means the athlete is not executing the drill correctly, often representing a break in momentum. However, back-foot counter-rotation after contact with the ground is completely normal. Unless the athlete is extremely mobile, the back foot is going to counter-rotate due to the following chain of events: As the center of mass continues towards the wall, the arm action going through the Pickup Phase causes scap retraction on the throwing side, resulting in

counter-rotation of the torso in turn causing slight counter-rotation of the pelvis, thus creating counter-rotation of the back foot. How much counter-rotation each body part goes through during the Roll-In Throw depends on each athlete's mobility.

Loss of Trunk Stack into SFC

Athletes commonly lose their trunk stack as the stride foot makes contact with the ground. While sometimes this is due to an arm-action deficiency or a mobility constraint, it is often just a general movement-pattern deficiency resulting from trying to throw everything low for an extended period of time. Simply reinforcing the correct target level on the wall and reminding the athlete to keep the chest up as long as possible into stride-foot contact are usually effective strategies for correcting this mistake.

Side note: Lead-leg blocking deficiencies are also common with this drill, but we address this issue in the explanation of Rocker Throws since they are the primary drill to fix this issue.

EXECUTING THE ROLL-IN THROW

Beginner Level Method

Executing this drill at a beginner level is fairly easy. The first step is for the athlete to face the target, standing comfortably with the throwing hand holding the ball in a neutral position (palm facing the hip, thumb up) slightly in front of and at waist level. Once this starting position has been established, simply walk towards the wall/target (distance of the walk may depend on how much space the athlete has to work with), make sure to not actively plant the back foot sideways, step with the normal stride leg, and throw the ball. If the athlete's trunk does not close off all the way, this is fine. Emphasize the linear component with this drill.

Intermediate Level Method

Once the basic Roll-In Throw movement has been established at a beginner level, the primary goal for executing this drill at an intermediate level is to help the athlete optimize trunk stacking. Assuming all of the steps from the beginner level are followed, have the athlete keep the chest up as much as possible into foot strike. Trunk stacking can be subjective, so to make it simple: if the athlete's shoulders are fairly level and the throwing-side scap appears pinned back at stride-foot contact, then the athlete has sufficiently kept the trunk stacked.

Advanced Level Method

Performing Roll-In Throws at an advanced Level is mostly a combination of elite upper-half movements at high intensities and executing the intermediate level steps very well. To keep it simple, if an athlete displays great arm action, trunk stack, positive disconnection, lead-leg blocking, and does not show any signs of common mistakes, then the athlete is likely performing this drill at an advanced level.

Coach's Note: Athletes and coaches are often confused about how we approach arm action for this drill, mostly regarding a short- or long-arm action. Let's address this briefly. If an athlete uses his full-arm action for Roll-In Throws, and the arm action has nothing wrong with it, does it really need to be changed for the purpose of the drill? Again, the Roll-In Throw is designed to drill trunk stacking and lead-leg blocking, so as long as the arm action isn't bad, we usually leave it alone. If you notice that an athlete's arm action has become inefficient during this drill, then it's wise to step in and have the athlete keep the arm action compact as the center of mass travels towards the wall/target. If you need ideas for helping an athlete keep his arm action compact on this drill, then read the Scap-Retraction Throws section for an explanation on optimizing the Pickup Phase.

Rocker Throws

CLASSIFICATION
Varied Standard PlyoCare Drill

DRILL PURPOSE
Rocker Throws help athletes isolate the lead-leg blocking movement pattern by removing the stride from the equation. This drill also should help the athlete self-organize an optimal trunk-rotation pattern, which is somewhat mutually inclusive with feeling the lead-leg blocking movement pattern.

COMMON MISTAKES

When athletes are executing Rocker Throws, here are three common mistakes to look for:

Incorrect Stance

We cover how to start with a correct stance in the Method section below, but look out for these common mistakes regarding stance:

1. *Too narrow of a base*
2. *Lead foot facing the wrong direction*
3. *Center of gravity is too high*

An athlete's starting with too narrow of a base can hinder his ability to properly block with the lead leg due to the lead foot's close proximity to the center of mass. More distance is not necessarily better, but the lead foot should be far enough away from the torso to create an appropriate lead-leg blocking angle to stop the center of mass's linear momentum. If you observe athletes flying over the top of the lead leg when they throw, chances are good that they have too narrow of a base. If an athlete starts out with the lead foot facing the wrong direction, he may not get an accurate feel for how the lead leg works in a throw, which minimizes the odds of the newly learned movement patterns of transferring to a pitch or regular throw. Athletes that start with too high of a center of gravity sometimes have too narrow of a base to start out with, but sometimes it's as simple as accidentally having their legs locked out. A quick solution is to have them sink their hips a little to gain some flexion in the legs so they can shift their weight with the lower half.

Lack of a Lead Leg Block

We mentioned in the Roll-In Throws section that lead-leg blocking deficiencies are common in many athletes during PlyoCare drills. This is the primary drill where we seek to fix lead-leg blocking issues. If athletes are having trouble properly utilizing the lead leg, check for the following issues:

1. *Too narrow of a base*
2. *Hamstring-flexibility issues*
3. *Hip-mobility issues*

As mentioned before, having too narrow of a base can minimize the lead leg's effectiveness in stopping the center of mass's linear momentum. For points two and three, refer back to the athlete's mobility screen to check for these. If the athlete fits somewhere in points two and/or three, then the athlete's lead-leg movement pattern may clean up over time through continued execution of corrective exercises. If athletes fit none of the three points, then they likely just have trouble feeling the movement pattern. In these cases, it's up to the coach's discretion on how help each individual athlete feels the correct lead-leg blocking movement pattern.

Leaving the Back Foot on the Ground

We've seen plenty of athletes try to leave the back foot on the ground during their first attempts at performing Rocker Throws. The general idea of Rocker Throws is not unique to Driveline; many athletes have gone through versions of this drill in which they are instructed to leave the back foot on the ground. The internal cue of "finish the pitch" typically solves this issue very quickly without affecting the athlete's intent.

EXECUTING THE ROCKER THROW

Method

The Rocker Throw is not a complex drill, so breaking it down into different levels of mastery is not necessary. The first step is to establish a solid starting base, which is the most technical part of the drill. To start out, the athlete's back foot should be parallel with the rubber, the lead foot very slightly internally rotated to face the wall/target (realistic landing position). Make sure the lead foot is far enough away from the center of mass to create a good lead-leg blocking angle, which may understandably take some trial and error to figure out. Once the ideal base width is established, lower the center of gravity a little (sink the hips) to create flexion in the knees to allow for lower-half movement.

After the center of gravity is slightly lowered, the athlete is ready to proceed with the remainder of the drill. While keeping the upper half stacked, simply shift the weight forward with the lead leg, then shift the weight to the back leg, then explode off of the back leg to supply some linear momentum, and throw the ball. When exploding off of the back leg, try to drive the center of mass towards the wall/target (X plane), not straight up towards the sky (Z plane). Use the lead leg to put force in the ground towards the target (X plane) to stabilize the lead leg while the throwing shoulder rotates forward towards the wall/target, which should help train the lead-leg blocking mechanism.

Walking-Windup Throws

CLASSIFICATION
Varied Standard PlyoCare Drill

DRILL PURPOSE
Walking-Windup Throws are purposely the least constrained and least complex PlyoCare drill. They simply teach athletes to optimize their athleticism and intent during a pitch. From a more technical perspective, the Walking-Windup Throw combines the lower-half rotation component with the linear component learned with the Roll-In Throw. This drill is essentially a progression from Roll-Ins, though we have athletes perform them after Rocker Throws to blend the correct lead-leg blocking and trunk-rotation patterns into a throw that closely mimics the pitching delivery. This drill is done with a quick pace to minimize wasted movement and maximize kinetic-sequencing efficiency.

COMMON MISTAKES
The least technical drill of the bunch, there are only two common ways athletes tend to make mistakes with Walking-Windup Throws. This drill is meant to blend the throwing patterns learned from the other PlyoCare drills into an athletic throwing movement, so most throwing-pattern deficiencies will be targeted in other drills.

Stopping Momentum at Max Leg Lift

The word "windup" within the drill name is often mistaken by athletes as a cue to take their time and stop momentum at max leg lift. While we cover the more technical explanation of how to execute this drill below, athletes should actually perform this drill with a high sense of urgency. Here's an effective way to communicate this to them: have them envision the sense of urgency they would use to pitch with if Billy Hamilton (or insert another serious base-stealing threat) was on first base, and they know he's about to steal second base. They're likely to minimize their time to home plate, right? Have them apply that kind of sense of urgency to Walking-Windup Throws.

At the same time, this drill does not specifically teach the concept of "drift." How each athlete projects his center of mass towards the target at max left lift varies between athletes. Allow them to play around with the drill to find the right feel for them. Feedback from radar guns can also play a key role in this self-discovery process.

Step-Behind Technique

We always emphasize being as athletic as possible within this drill, so sometimes athletes take this cue a step too far and use a Step-Behind Technique, similar to the footwork they would use on a Pulldown (more on technique in the Pulldowns chapter). To correct this, simply follow the steps outlined below.

EXECUTING THE WALKING-WINDUP THROW

Method

The first step to correctly executing a Walking-Windup Throw is to establish the target and to establish a throwing lane (create an imaginary straight line) towards that target. Once the throwing lane has been established, take a couple of steps off to the glove side, exactly like a field-goal kicker does in football. When the athlete gets to this starting position, have them walk in an upbeat fashion towards the throwing lane at an angle. The distance this walk covers depends on the amount of space available, as well as what each athlete feels comfortable with. When the athlete is ready to make his throwing movement and has reached his throwing lane, he should plant the back foot, lift the lead leg, and redirect his momentum towards the target. Some athletes use a full leg lift, whereas others only use an abbreviated leg lift, or even a slide step. There's no right or wrong way to lift the lead leg as long as it helps optimize the athlete's ability to perform the rest of the drill correctly. After momentum has been redirected, throw the ball as athletically as possible.

We are commonly asked questions about why we have athletes walk in at an angle and not straight on towards the target. Have you ever tried to maintain your momentum towards the target while also turning a full 90 degrees and lifting your lead leg to max leg lift at the same time? It's nearly impossible. Walking straight to the target contributes to athletes' stalling their momentum, so we adjusted the drill to walk in at an angle so athletes would only have to turn their bodies about 45 degrees, making it much easier to maintain momentum and optimize athleticism throughout the drill.

Scap-Retraction Throws

CLASSIFICATION
Overload Specialized PlyoCare Drill

DRILL PURPOSE
Scap-Retraction Throws are specifically designed for athletes that have an arm action dominated by the throwing hand's traveling towards 2nd base. None of the standard PlyoCare drills cover this particular arm-action deficiency, so we implemented this drill to help athletes feel how the elbow movement dominates the arm action during the Pickup Phase. The ultimate goal for this drill is to take steps towards creating a Pickup Phase that helps retract the athletes' throwing-side scap to maintain trunk stack into stride-foot contact and to optimize their ability to create positive disconnection. This drill is usually performed between Pivot-Pickoff Throws and Roll-In Throws. Performing Scap-Retraction Throws after Pivot-Pickoff Throws helps blend Elbow-Spiral and Driveline Phase concepts into a more complete arm action, and performing this drill before Roll-In Throws helps blend a more ideal arm action with a throw containing a linear component.

IDENTIFYING THE RIGHT CANDIDATES
Without question, determining which athletes are candidates for this drill is subjective, but we provide descriptions here to help you make the most educated programming decisions.

Rule #1: Always look at the effect on the Elbow-Spiral Phase to determine if the athlete's Pickup Phase needs to be adjusted. Here's a list of issues we look for when considering implementing this drill into an athlete's routine:

Reaching Towards 2nd Base

Some athletes have an arm action that is clearly dominated by the throwing hand's traveling towards second base while the center of mass is traveling towards home plate. If the athlete's throwing arm tends to extend towards second base when separating the hands and in turn creates an inability to roll into a good Elbow-Spiral Phase, then Scap-Retraction Throws are a great way to target this deficiency.

Coach's Note: Don't confuse this deficiency for the athletes' forearm appearing to point towards 2nd base a little bit when their throwing-side scap retracts during a clean Pickup Phase. Refer back to Rule #1.

Pronated Takeaway

If an athlete has a very pronated throwing hand when the hands separate, odds are he also has excessive elbow climb that creates excessive shoulder abduction (leading to the Inverted W position at stride-foot contact), assuming this pronated position is maintained during the Pickup Phase. This drill helps neutralize the throwing hand during the Pickup Phase, mapping a cleaner arm path by making scap retraction have a more prominent role during the Pickup Phase.

Immediate Elbow/Forearm Elevation

We don't see this problem much in person at our facility, but we do acknowledge that it exists. Some athletes immediately take their forearm and elbow upwards at the same time as soon as the hands separate. This typically leads to early trunk rotation since the throwing-side scap minimally retracts, creating nothing to hold the shoulders closed as the glove arm begins to clear. This deficiency can even have an adverse effect on how the lower half works, often creating the need to land early since the throwing arm is in a position to go into the Elbow-Spiral Phase too soon. This can lead to creating a less than ideal lead-leg blocking angle, as well as minimal hip/shoulder separation because the hips have minimal time to rotate. Implementing this drill correctly can be the first step to addressing several problems at once.

EXECUTING THE SCAP RETRACTION THROW

Method

The beauty in Scap-Retraction Throws is that they are incredibly easy to perform. They're understandably awkward at first for any athlete with a major arm-action issue, but the technique is very easy. First, establish the location of the wall/target and turn in a position so that the glove side is facing it, much like pitching from the stretch. Hold the ball in a neutral position with the throwing hand (palm facing the hip, thumb up) slightly in front of the body at waist level, exactly like the preset position for a Roll-In Throw. After the starting position has been established, the athlete should approach the throw

like he's playing catch with the wall/target. To break this drill down in a more technical manner, when the athlete takes a small stride towards the target, the first move to make with the throwing arm should be to take the elbow in a posterior direction (like a single arm row) instead of letting the hand/forearm travel towards 2nd base. Once the stride and first move with the throwing arm is made, simply throw the ball. While this may appear choppy at first for some athletes, the eventual end product to shoot for is a fluid movement that improves the efficiency of the athlete's arm action.

Step-Back Throws

CLASSIFICATION
Varied Specialized PlyoCare Drill

DRILL PURPOSE
Step-Back Throws were designed to optimize how athletes transition their center of mass down the mound by reorganizing the lower-half kinematics. No, this drill is *not* for teaching the athlete how to "push off" with the back leg... sort of. We discussed in the Lower-Half Pitching Mechanics chapter the main roles of the back leg:

1. *It is not the sole driving force, but it does aid the linear movement of the athlete's center of mass down the mound and towards the target. This means the speed of transition, distance covered, etc. This plays a direct role in setting a lead-leg blocking angle and the amount of time the hips have to rotate*
2. *Weight distribution and timing of when the back foot disengages from the rubber plays a role in an ability to maintain trunk stack*
3. *While mobility also plays a role, the back-leg movement pattern can create a counterbalance mechanism that aids in the role of creating anterior pelvic tilt when the hips rotate. This clears space for trunk flexion towards the target*

This drill is a replacement for Walking-Windup Throws for athletes that have already mastered throwing as athletically as possible, but who need to learn how to maximize their lower-half efficiency. Step-Back Throws overload the linear component by making the athlete reverse direction out of a slightly exaggerated amount of back leg flexion. This drill also helps athletes figure out their back-foot weight distribution, as well as help them find their own ideal timing for when to release the back-foot anchor.

IDENTIFYING THE RIGHT CANDIDATES

This drill should be implemented much more sparingly than Scap-Retraction Throws because perfecting lower-half movement patterns, particularly the kinematics during the transition of the center of mass towards the target, should be saved as the absolute last thing on the agenda. Mastering the Standard PlyoCare drills, the intent to throw gas, and maximizing upper-half mechanical efficiency should all come first before trying to eke out that last little bit of velocity from tweaking the lower half. If an athlete has mastered those three areas and you suspect that his lower half can still improve, here are some signs that Step-Back Throws may be a welcome replacement for Walking-Windup Throws:

Early Release of Back Foot Anchor

To be fair, it's virtually impossible to quantify this deficiency, especially when it's not terribly obvious. However, there are a few signs that show the back-foot anchor releasing from the ground too early:

- *Minimal amount of trunk flexion during the Driveline Phase. This will also be related to how much anterior pelvic tilt is created when the hips rotate.*
- *Back knee pulls very close to the lead leg, making the back-leg femur appear completely vertical. You may notice in more extreme cases where the back knee pulls so close to the lead leg that the femur goes past vertical.*
- *Back foot pulls high off of the ground during the early stages of trunk rotation.*

The three signs listed above are generally related to one another, and we've listed them in order if you're thinking in terms of backwards chaining. That means if one reverse engineers the listed order, the back foot's pulling off of the ground early creates the ability for the athlete to pull the back knee close to the lead leg, minimizing the counterbalance the back leg creates, thus minimizing anterior pelvic tilt and trunk flexion. See, isn't this fun? The description of how to perform the drill will help move athletes towards fixing this issue.

Upward Direction of Hip Extension

Some athletes have the tendency to extend their back leg, and also the back hip, in an upward direction, rather than towards the target. It's important to reiterate that we are not advocates of striding as far as possible, but if an athlete's stride seems like it's too short, then upward hip extension may be the culprit. While this can be a sign of a breakdown of the linear component, it also can mean that the athlete probably understands the general concept of how to use the back leg, but needs to adjust his weight distribution and understanding of back-foot anchoring.

EXECUTING THE STEP-BACK THROW

Step-Back Throws are easy to execute in principle, but fairly technical to explain. To perform this drill, face the body in a manner so the glove side is pointing at the target. Once the starting position has been established, take a small step (roughly 2 feet or so in length) away from the target with the back foot at a medium tempo. The athlete should begin to lower the center of gravity to create flexion in the back leg and the hips as the center of mass transitions onto the back leg. An appropriate internal cue might be to have the athlete envision "sitting in a chair" during this movement. Once the center of mass has transitioned to the back leg, the athlete should slightly lift the lead leg and let it slightly cross over the back leg so that the lead foot is on the 2nd base side of the back foot. This is the perfect time to establish the correct weight distribution on the back foot—on the middle to outside of the foot.

When the athlete has totally stopped his momentum going towards 2nd base, the first move should be to aggressively swing the lead leg towards the target to jumpstart the center of mass transition. While the lead leg swings towards the target, the athlete should simultaneously extend the back leg, having the feeling of "spreading the floor" with the back foot. This is *not* to create a goal of applying as much force as possible; it's just to help athletes apply force with the back foot away from the target (X plane) instead of upward (Z plane). The goal should be to maintain weight distribution on the back foot, keeping it anchored to the ground as long as possible while the center of mass is moving towards the target. When the lead leg begins to make its move into landing, the hips will begin to open and the back foot will pivot accordingly without any conscious focus. As the lower half unwinds, the athlete should execute upper-half throwing mechanics as normal.

It's typical for this drill to be a little awkward for athletes to execute when first trying it, particularly with moving their center of mass out of an amount of back leg flexion that they are not accustomed to. For athletes first beginning this drill, create a primary focus of mastering their weight distribution and back-foot anchoring. As they become more proficient with the drill, challenge them to slowly create more back leg flexion over time. Before implementing this drill, we highly recommend watching our Step-Back Throws video on our website to put a visual together with the drill explanation.

6

LONG TOSS:
Auto-Regulated Throwing

Long toss has seen an eruption of popularity in the last decade, with MLB organizations jumping on board to allow their athletes to throw near-unlimited distances with no restriction on time or frequency. We support this movement and have integrated long toss within *Hacking the Kinetic Chain — Advanced Pitching*, because in our mind, there is no better way for athletes to auto-regulate their effort and gently reorganize the chaos of increased intent into their throwing mechanics when learning new mechanical patterns. The long-toss variant we use is the **extension-compression model**, made famous by Alan Jaeger and Jaeger Sports.

The extension-compression model as detailed in Jaeger's *Year Round Throwing Manual* was the focus of a research study to look at the kinematics and kinetics of throwing maximum-distance long toss. American Sports Medicine Institute (ASMI) showed that maximum-distance long-toss throws displayed significantly higher kinematic parameters compared to pitches thrown off a mound in the following areas:

- *Maximum Shoulder External Rotation (MER)*
- *Elbow Flexion*
- *Internal Rotation Torque*
- *Elbow Varus Torque*
- *Elbow Extension Velocity*

ASMI then concluded that maximum-distance throws should be cautioned for use when it came to rehabilitation or training purposes. The Internet exploded with controversy, and the simplistic argument "long toss is bad for you because it increases force" was trotted out by more than one pundit. Like most things, the reality is significantly more complex.

Research absolutely does show that kinematics and kinetics increase when a pitcher throws at maximum distances with a large upward trajectory. However, **this is a good thing**, *not* a bad thing. The entire concept of training to develop a stronger arm involves progressive overloading, and the fact that maximum distance throws exceed kinematic parameters displayed on the mound means that this training modality is an excellent overloading stimulus. While ball velocity was not significantly different (though it's possible that measurement error played a role), the increased values of internal-rotation torque, shoulder external rotation, and elbow-extension velocity all strongly correlate with throwing a ball harder. By developing these angular velocities and ranges of motion through long toss, the pitcher develops the real ability to express this on the mound later on—connecting the neural adaptations to the body's natural mechanics.

Despite the very strong evidence behind the fact that long toss increases positive kinematic parameters that lead to increased ball velocity, the auto-regulated methodology is perhaps the most valuable piece of the exercise. The extension-compression model allows athletes to integrate mechanical concepts learned from PlyoCare drills into long toss to give immediate feedback on how well the throwing patterns are connecting to velocity and power.

Extension-Compression Model

Long toss has two phases: extension and compression. The **extension phase** starts at a close distance where two athletes play very light catch. With each throw, or number of throws, the athletes gradually increase the distance between them, continuing until they reach their maximum tolerance distances for the day. During this phase, there is a gradual increase in the ball flight's arc as the distance increases. The important thing here is that each throw in the extension phase is done with a loose arm with the purpose of building freedom in the delivery, not constricting ranges of motion.

Once the athletes have reached their maximum tolerance distance for the day, the next step is to begin the **compression phase**. Each throw is now meant to be "pulled down" with at least the same intent as the furthest throw during the extension phase. The goal is to keep the trajectory low, gradually closing the distance after each throw is completed. The idea is to compress a maximum-distance throw into a 70-90 foot throw to build arm speed-strength. If the two athletes have premium velocity, such as college and professional-level athletes, it's likely best to not compress any closer than 90 feet for the safety of the athletes.

Our athletes typically perform the standard extension and compression phases outlined by Jaeger, but if you'd like to see a way to incorporate the movements from our PlyoCare drills into a long toss progression, consider the following example:

EXTENSION PHASE:

- The athletes start 30 feet from each other and play catch by starting off with five Pivot-Pickoff Throws, aiming for the mid-chest and keeping the arm very loose. Once completed, move back to 45 feet and repeat the same exercise and reps.
- Next, the athletes should back up to 60 feet, completing five Rocker Throws to the partner, still keeping looseness and freedom in the arm while also feeling the lead-leg blocking and trunk-rotation relationship. Once completed, back up to 75 feet and repeat the same exercise and reps.
- Back up to 90 feet and complete five Roll-In Throws. Repeat the same exercise and reps at 120 feet.
- When the athletes back up to 150 feet, begin to shuffle the feet (or use a crow hop, to each their own) completing 3-5 throws.
- Continue to back up 10 feet per every 2-3 throws, with the athletes eventually reaching their maximum tolerance distance for the day, concluding the extension phase.

COMPRESSION PHASE:

- By using a crow hop, or the pulldown technique outlined in the Weighted-Ball Pulldowns chapter, athletes should begin the compression phase at a distance that is roughly 70% of their maximum tolerance distance. Make sure the ball is being thrown on a line.
- Athletes should move in about 10 feet for every throw made, stopping between 70 and 90 feet, depending on each athlete's throwing velocity. Once at the final distance, complete 3-5 throws.
- Move in to 45-60 feet and complete ten **Pivot-Pickoff Throws** or regular catch-play throws at a very light intensity with a very loose arm action to function as a throwing cooldown.

Weighted-Ball Long Toss

A question our customer-service team has received many times over the past couple of years is "Can I long toss with weighted balls?"

Yes, absolutely! Using the Driveline Leather Weighted Balls is a tremendous way to increase proprioception and test force acceptance during long toss. From a programming standpoint, utilizing weighted balls during long toss can be appropriate on different variations of hybrid training days. We do not officially program weighted-ball long toss into our athletes' routines because we believe they should have the freedom to choose their own style of long toss. But, for those that would like to try long tossing with weighted balls, here's a sample progression for an athlete between 17-21 years of age:

EXTENSION PHASE:

- Begin between 30-45 feet with a 9- or 11-oz. ball, and lightly throw until the throwing partner has reached 75-90 feet.
- Once at 75-90 feet, pick up a 6- or 7-oz. ball and begin shuffling the feet, extending out to between 175-200 feet.
- When in the 175-200-foot range, pick up a baseball and work out to maximum tolerance distance.

COMPRESSION PHASE:

- Start at about 60% of maximum tolerance distance with a baseball and perform 4-6 compression throws, decreasing the distance by 10 feet after each throw
- After the baseball throws, pick up a 4-oz. ball and perform 3-5 compression throws until the 80-100-foot mark has been reached

Coach's Note: Both the baseball and weighted-ball progressions listed above can be performed indoors if the conditions are not fit for the athlete to throw to a partner outside. The indoor long-toss concept is simple in nature, but check out the Indoor Long Toss section at the end of the Covering the Intangibles chapter if you want more information.

7

VELOCITY TESTING with Weighted Baseballs

Background on Weighted Baseballs

Training with weighted baseballs has been around for decades, and their effectiveness at developing velocity has been proven time and time again in peer-reviewed journal articles by authors like Dr. John Bagonzi, Dr. Coop DeRenne, Alan Blitzblau, and many others. Many of these articles also focus on arm health, and no research study using weighted baseballs has concluded that they were inherently more likely to cause arm injuries. Furthermore, our own study on using 3–7-oz. weighted baseballs for velocity testing in early 2017, featuring a test group of elite athletes using the motusBASEBALL sleeve, found no statistical difference in either elbow stress or shoulder rotation range of motion. While it's certainly possible that future tests with a full marker-based solution could yield different results, for the time being there is insufficient evidence that either underloaded implements or overloaded implements are more stressful on the arm compared to a baseball when thrown at max effort.

At Driveline Baseball we have continually tested and retested the use of stitched, hard-cover weighted baseballs since 2007, and we still use them with our older athletes. *For youth athletes, we suggest using PlyoCare balls only as outlined in Hacking the Kinetic Chain- Youth, our guide focusing on pre-high school pitchers.* We have cycled in mechanic-specific drills with them to gauge the effectiveness of using constraint-based methods to improve kinesthetic awareness of the pitching arm, and the success with these methods eventually caused us to develop softer- and heavier-weighted implements, which is how PlyoCare balls came into existence. After years of trial and error, we have developed a truly elite product in our Driveline Leather Weighted Balls, which are designed to have the same feel and durability as a game ball.

Velocity Testing: Pulldowns

While our weighted baseballs can be used for a variety of things, such as command work and long toss, there's no mistaking the fact that they were primarily designed for one thing: to push the body's ability to throw absolute gas!

The use of overload/underload-weighted baseballs thrown at maximal RPE helps reorganize the delivery in ways that traditional instruction can never assist with. An athlete cannot consciously control the arm at high intensities due to the rapid angular velocities occurring at the shoulder, meaning that countless reps with an unloaded pitching arm are largely a waste of time. Our goal is for the athletes to use the constraint drills with PlyoCare balls to maximize the efficiency of their throwing patterns and to use the Leather Weighted Baseballs to imprint those patterns by challenging the neuromuscular systems at the highest possible intensities.

To create the greatest challenge for the body during velocity testing, we have our athletes use a technique that resembles a crow hop, run and gun, shuffle step, or whatever it takes to throw the ball as hard as possible. A general rule for technique is the best athletes at weighted-ball velocity testing (aka "Pulldowns") tend to cover around 10 yards (or sometimes a little more) of ground before throwing the ball. It's difficult to run straight on towards the target and turn 90 degrees to get sideways without killing momentum, so our athletes tend to start out on their glove side of the target, creating a banana route into the middle of the throwing lane before taking their last few steps in a sideways position before throwing the ball. It's wise to start out slow at first with the footwork and gradually work up to operational speed. Assuming all things are equal, a faster pace is better. However, we all know an infinite linear relationship between movement pace and throwing velocity is not real. The athletes' movement pace should push them to move fast enough that they push their ability to properly sequence the kinematics, but not too fast to the point where they are simply running out of control. These are running throws, not throwing runs. For a more in-depth look at Pulldown technique, go to our website to check out the video on this exercise.

Executing a Pulldown Session

The throwing programs briefly outline the progression for Pulldown sessions, but let's go ahead and discuss at length what one of these training days looks like, as well as the benefits and reasons behind the progression.

The first step to going through a Pulldown session is understanding that the approach to the warm-up process is just like a game day. That means progressing PlyoCare throws slowly from low to high RPE. For example, Reverse Throws, Pivot Pickoffs, and Roll-Ins should be started at a low intensity, with the athlete slowly increasing RPE after each throw. By the time athletes get to Rocker Throws and Walking-Windup Throws, they should begin to increase their RPE above 85%. Once PlyoCare throws have been completed, the athlete should do whatever it takes to put himself in a position to be able to throw at 100% RPE for velocity testing. This often entails some sort of combination of the Jaeger long toss extension and compression phases, but it's ultimately up to each athlete to decide on how to optimize his own readiness for 100% RPE throwing.

Casey Weathers pulling down 107.8 mph with a baseball on January 12, 2016, a facility record that has stood for 1.5 years and counting

An example Pulldown progression looks something like this:

Regulation baseball	**1 throw @ 80% RPE, 3–4 throws @ 100% RPE**
6-oz. weighted baseball	**1 throw @ 80% RPE, 3–4 throws @ 100% RPE**
7-oz. weighted baseball	**1 throw @ 80% RPE, 3–4 throws @ 100% RPE**
Regulation baseball	**3–4 throws @ 100% RPE**
4-oz. weighted baseball	**1 throw @ 80% RPE, 3–4 throws @ 100% RPE**
3-oz. weighted baseball	**1 throw @ 80% RPE, 3–4 throws @ 100% RPE**

The particular weighted baseballs thrown and the amount of reps per set varies between throwing programs, but the progression above represents a fairly standard weighted-baseball velocity testing day. It's definitely an unexpected sequence, since most people assume the order of throwing is 7, 6, 5, 4, 3 oz. Let's break down each step and explain why we have assembled the order this way.

By starting out with a regulation baseball, we present athletes with an opportunity to throw a familiar object first in order to help them gain confidence in their ability to execute a high-intent Pulldown. The first rep is done at 80% RPE to establish the footwork and timing they will use on their Pulldowns. After the 80% RPE throw is completed, the athlete will execute the prescribed number of throws on his program at 100% RPE. The prescribed number of throws will often be based on an athlete's age, overall workload, throwing fitness, and familiarity with throwing weighted balls. All things equal, athletes new to our programs will tend to have a lower vol-

ume of Pulldowns than athletes that are seasoned veterans. We mostly care about charting the highest velocity throw, but we also encourage creativity with charting velocity data as well. There's nothing wrong with charting the athlete's minimum, average, maximum, or any other statistics.

We have athletes use a 6-oz. weighted baseball right after the regulation baseball because it's the most subtle change in weight while also working the athlete towards throwing overloaded baseballs at max effort. The first throw with the 6-oz. ball is at 80% RPE to help the athlete gain familiarity with the new implement. Execute the prescribed number of throws at 100% RPE, then repeat the same exact steps with the 7-oz. ball.

As you can see, we have the athletes work up slowly in weight until they reach the 7-oz. ball. To be clear, 9- and 11-oz. weighted baseballs are meant for catch-play use and are not programmed into velocity testing days. We incorporate overloaded baseballs into Pulldown sessions because EMG studies have shown that there is increased activation of the pronator-flexor mass when using them, with pronation angular velocity of the forearm significantly higher as well. Throwing overloaded baseballs is a great method for developing speed-strength and driving physiological adaptation of the muscles responsible for protecting the UCL because the brain understands the need for the body to properly decelerate and support the elbow when they are thrown at maximal intensities. Overloaded baseballs also help maximize the efficiency of the Pickup Phase, Elbow-Spiral Phase, and Driveline Phases, optimizing ability to create ball speed.

After the athlete is done with their 7-oz. weighted-baseball throws, the next step is to transition back to the regulation baseball immediately at 100% RPE and complete the prescribed number of reps. We originally programmed this transition due to the concept of **post-activation potentiation**, the idea that the central nervous system (CNS) may be primed at a higher level after throwing overloaded baseballs. However, our velocity-testing data collection over the last several years points to no correlation between throwing overloaded baseballs and immediate improvement in velocity with the regulation baseball. Instead, the results have been fairly split, with some athletes improving regulation-baseball velocity right after throwing overloaded baseballs, whereas other athletes decrease in regulation-baseball velocity. The exact reasons for this are still unknown, and further research on different types of athletes is an ongoing task for us. Still, we find this progression a reasonable means to translate the more efficient throwing patterns learned with an overloaded baseball to a throw with a regulation baseball.

Once athletes finish their second round of regulation baseball throws, they moves on to throws with the 4-oz. weighted baseball, repeating the original sequence of the first throw performed at 80% RPE, with the next several throws performed at 100% RPE. To finish the velocity testing day, athletes will repeat the same exact sequence with the 3-oz. weighted baseball. These underloaded baseballs are utilized in Pulldown sessions for the following reasons:

- *The ability to move the arm at supramaximal speeds teaches the body to move quicker and to preferentially recruit even more "fast twitch" muscle fibers due to higher peak output of the ballistic profile.*
- *Doing so presents a challenge to the body to transfer the throwing patterns learned from using PlyoCare balls, overloaded baseballs, wrist weights, and long toss to lighter implements.*

As noted earlier in this chapter, our own studies using the motusBASEBALL sleeve have revealed that underloaded baseballs are *not* more stressful than a regulation baseball. The reasons why are unclear for now, but here are a few things we do know. First, due to an artificially lower inertial mass, internal rotation of the throwing arm is cued slightly earlier than it normally would be with a regulation baseball, causing the arm to accelerate faster. Continuing to push the ability to increase arm-acceleration speeds cannot be done in any other way than throwing underloaded implements.

Throwing underloaded baseballs also creates additional kinesthetic awareness of how the arm works in the high-level pitching delivery. The athlete's release point often shifts closer to the body due to the quicker unwinding of internal rotation, making it common for athletes to spike their first several underload baseballs. Athletes are challenged to transfer throwing patterns from PlyoCare drills and other modalities, because throwing underloaded baseballs is the least-constrained activity the athlete can perform, meaning there is the most room for error. For example, it's somewhat easy for an athlete to self-organize the ability to create forward shoulder rotation and drive the throwing hand over the elbow when throwing a 1-kg PlyoCare ball. What happens if that movement is immediately attempted with a 3-oz. weighted baseball? Decreased proprioception and increased arm speed make it easy for the brain to lose track of where the arm is in space, likely causing a breakdown in throwing-movement efficiency. Progressively reducing the weight over time towards underloaded implements continues to challenge the neuromuscular system to avoid the forearm's losing control of the direction of elbow extension. Purposely making the task at hand tougher on athletes' neuromuscular system helps them regain the ability to make improvements rather than go through the motions with an implement that has long been mastered.

Understanding Velocity Spreads

The actual numerical differences between each weighted-baseball velocity can tell us many things about an athlete, sometimes before even seeing them for the first time. Here are the two most common scenarios we have encountered over the last several years:

1. *Perfect positive linear slope, with the 7-oz. ball being the lowest velocity and the 3-oz. ball being the highest. For example, 7 oz. = 88 mph, 6 oz. = 90 mph, 5 oz. = 93 mph, 4 oz. = 95 mph, 3 oz. = 98 mph.*
2. *Perfect positive linear slope from the 7-oz. ball to the regulation baseball, then the underload balls taper off onto a slope of about zero. For example, 7 oz. = 88 mph, 6 oz. = 90 mph, 5 oz. = 92 mph, 4 oz. = 92 mph, 3 oz. = 93 mph.*

Scenario 1 is the ideal result to shoot for. The velocity difference between the 7-oz. and 5-oz. balls should be 5-6 mph and the velocity difference between the 5-oz. and 3-oz. balls should also be 5-6 mph. This generally tells us that the athlete is healthy and has overall good throwing patterns. Scenario 2 isn't the worst result by any means, but it does tell us that the athlete may have a few problems. These issues can range from a subpar ability to accept force, inefficient throwing patterns, or perhaps a previous injury history related to both of those, causing a breakdown when transitioning to underloaded baseballs.

While we have seen scenarios where athletes have a perfect negative linear slope (7 oz. = highest velo, 3 oz. = lowest velo) and perfect zero linear slope (all velocities are the same), they aren't particularly common. Whatever the case is, the goal is for the

athlete's velocity spreads to look similar to scenario 1 while also increasing their velocities across the board. This usually points back to the athlete seeking to improve his throwing patterns and force acceptance while pushing his intent by consistently competing against his own velocity numbers on Pulldown days.

Projecting Mound Results

"Hey look, that guy can throw really hard with a running start. What does that equal to on the mound?"

This is possibly the most common question we have received throughout the history of our company and, to be fair, it's a completely valid question. Athletes don't get to pitch with a running start, so that means there needs to be some sort of parallel between the two events, right?

In short, there is no direct translation between mound throws and Pulldowns. What we mean by that is if Athlete A's baseline numbers are 85 mph off of the mound and 89 mph on a Pulldown, then a 4-mph increase on Pulldowns doesn't necessarily guarantee a 4-mph increase on the mound as well. However, our data collection over the last several years has given us enough information to create these rules of thumb:

- *If all things are equal (total throwing movement and intent on both mound throws and Pulldowns is either good or bad) then there's usually a gap of 4-6 mph between Pulldowns and mound throws, with Pulldowns being the greater velocity. This gap can widen for elite athletes that have Pulldown velocities greater than 102 mph.*
- *If throwing patterns are good on Pulldowns, but poor on the mound, then the gap between Pulldowns and mound throws becomes larger than 7 mph.*
- *If throwing patterns are poor on Pulldowns, but good on the mound, then the gap between Pulldowns and mound throws becomes smaller than 4 mph. This means there are even cases where mound velocities can exceed Pulldown velocities.*

Our throwing programs are written with this information in mind to maximize the athletes' ability to blend the intent they learn on Pulldowns and the throwing patterns learned with PlyoCare drills to a slope, maximizing potential for their training to carry over to when it matters: game day.

8

POST-THROWING RECOVERY WORK

A comprehensive post-throwing recovery program is just as important as a pre-throwing warm-up phase. Whether the athlete has just finished pitching in a game, completed a Pulldown session, or has just completed a typical non-velocity testing workout day, the arm needs proper recovery to ensure an optimal-training effect and to reduce the chance of overuse injuries. A huge factor in velocity development is the athletes' ability to put forth their best effort on a regular basis, so the objective is to minimize the amount of bad training days. Simply put, any athlete that is not recovering is not consistently training at a high level. Athletes should stick around 30 minutes or so after their primary throwing workout to complete their post-throwing recovery work. This is an *absolute requirement* at our training facility.

Many of the post-throwing recovery exercises are the same as the pre-throwing warm-up exercises, but there are also a significant number of drills done to

help reinforce existing patterns and develop force-acceptance proficiency as well as passive methods to ensure that tissue pliability stays high. Let's outline our core post-throwing recovery exercises that were not discussed in the Pre-Throwing Warm-up chapter, as well as a few alternate exercises for scenarios in which the required equipment for the core post-throwing recovery exercises is unavailable.

Standing Rebounders

OVERVIEW

Catching PlyoCare balls that have been thrown against a mini-trampoline helps develop force acceptance at the elbow and shoulder, allowing those areas to absorb more stress during the pitching delivery by building a bigger deceleration engine. This is also a low-stress method to train the unwinding transition from supination to pronation and for athletes to feel how the ball is released from an ultimately neutral hand position. The specific weights of the PlyoCare balls used for this exercise can vary from program to program, but the goal is to use as heavy a PlyoCare ball as possible.

METHOD

With a PlyoCare ball in the throwing hand, stand close to the mini-trampoline. Making sure the athlete is close to the mini-trampoline is vital to train the correct unwinding of the arm, so one tip is to have the athlete place the feet on each side of one of the mini-trampoline legs. Once the starting position has been established, the next step is to raise the throwing arm up into a similar position as the Two-Arm Throws wrist-weights exercise (elbow up, palm next to the ear). The next step is to unwind the arm in a downward direction, throwing the ball into the trampoline. Here are two common mistakes to avoid while doing so:

1. *Pushing the ball*
2. *Unwinding with a supinated hand, similar to using a yo-yo*

The throwing arm should unwind so that it extends at waist height or below. Keep the arm extended, and catch the PlyoCare ball on the rebound, resisting the force pushing the arm upwards. If done correctly, the throwing arm will unwind and the ball will bounce off of the mini-trampoline back into the hand without having to move it.

BAND PULLAPARTS SERIES:

Reverse Scap Pullaparts

OVERVIEW

This exercise helps cue and restore proper function of the shoulder blades by driving the scaps down and back during the movement.

METHOD

With a red Rogue Monster band or a set of J-Bands, have the athlete stand in a stationary position with the bands held in the hands over the head. Simply pull the band down and back across the top of the upper back. The athlete should focus on driving the elbows down and tucking them back. This exercise is often done for 10 reps per set.

BAND PULLAPARTS SERIES:

Anterior Band Pullaparts

OVERVIEW

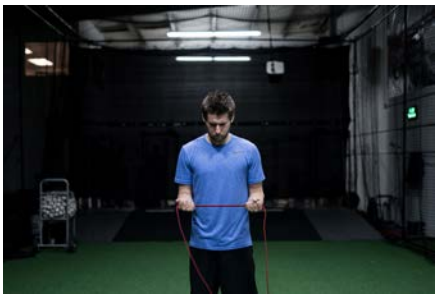
This exercise helps drive the shoulders backwards and reverses the "rolled forward" posture many pitchers find themselves in. This activates the entire shoulder-scapula complex.

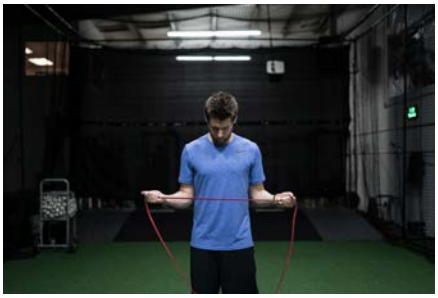
METHOD

To start, the athlete should stand in a stationary position and hold the band in front of the body with the palms facing downwards. While keeping the arms straight, the next step is to pull the band apart, which should cause it to touch the athlete's chest. Make sure to not lose tension at any point during or between reps. This exercise is often done on both 45-degree diagonal planes and the horizontal plane for 10 reps each (30 total).

BAND PULLAPARTS SERIES:

No Money Drill





OVERVIEW

This exercise activates the scapula retractors and helps to depress the height of the humerus to open the subacromial space. This helps strengthen the external rotators and the infraspinatus.

METHOD

In a stationary standing position, have the athlete hold the band in front of them with the palms up and the elbows tucked in to their sides. Spread the band while externally rotating at the shoulder. *Do not* move the elbows away from the body. This is not meant to be a huge movement—quality of movement is far more important than distance traveled. This exercise is also often done for 10 reps per set.

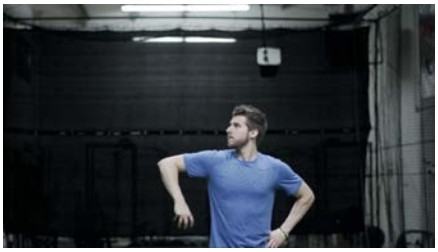
Waiter Walks

OVERVIEW

Waiter Walks challenge the dynamic stability of the shoulder-scapula complex as the rotator cuff fires on all cylinders to keep the weight in the air.

METHOD

The athlete should use a bottoms-up kettlebell grip (a weight plate is a decent substitute if no kettlebells are available) and hold the elbow directly to the side of the body at shoulder height. The wrist should be in a strong, fixed position—don't allow it to externally rotate, which will compromise the ability to hold the weight in the air. The free hand should hang down loosely. Once the starting position has been established, walk a defined distance (usually about 15-20 yards each direction) and keep the weight balanced in the waiter position. The athlete should try to keep the shoulders as level as possible while walking. If the weight happens to slip and fall, stop walking and reset the grip before proceeding with the walk towards the finish line.



Standing Upward Tosses

OVERVIEW

Standing Upward Tosses help train both external-rotation strength and internal-rotation deceleration by externally rotating to throw the ball upwards into the air and internally rotating to catch the ball as it makes its way down to the ground. This also gives the athlete good kinesthetic feedback on how the shoulder should operate during the arm-cocking phase of the delivery—with minimal elbow movement during external rotation and loading. This exercise is usually done with the heaviest PlyoCare ball, if possible, and can serve as an adequate replacement for Standing Rebounders if a mini-trampoline is not available.

METHOD

Start out in a stationary standing position with the glove hand lightly braced against the chest. With the PlyoCare ball in the throwing hand, hold the throwing arm out to the side in an internally rotated position with the elbow at roughly shoulder height. Once the starting position has been established, have the athlete externally rotate the shoulder while keeping the elbow at the same height and throw the PlyoCare ball into the air. When the PlyoCare ball falls towards the ground, catch it while internally rotating at the shoulder, attempting to slowly decelerate the ball's flight. Deceleration should take approximately one second.

Side-Lying External Rotation Tosses

OVERVIEW

This exercise maximizes activity in the external rotators due to the constrained starting position. Like Standing Upward Tosses, this exercise is usually done with the heaviest PlyoCare ball, if possible, and can serve as an adequate replacement for Standing Rebounders if a mini-trampoline is not available.

METHOD

To start, have the athlete lie down on the glove side ribcage with a foam roller or other object propping the head up. Once in the starting position, hold the throwing-arm elbow against the side and externally rotate the shoulder to throw the ball up, repeating the same steps as the Standing Upward Tosses to catch and decelerate the ball when it come back down.

NOTES for SIDEARM PITCHERS

We receive many questions regarding how the throwing routine should change for sidearm pitchers. You may be surprised to find out that it doesn't change much at all. Here are a few reasons why:

- *Throwing sidearm is mostly the function of a shift in posture, with very minimum change in actual arm slot relative to the spine. This does create subtle mechanical changes elsewhere in the delivery, but not enough for the entire throwing routine to change.*
- *Sidearm pitchers still need the ability to throw over the top when fielding their position.*

The warm-up and post-throwing recovery routines do not change at all; the only changes lie within the PlyoCare drills, Pulldowns, and long toss. Reverse Throws and Pivot Pickoffs are to be executed the standard way, but sidearm pitchers should begin working towards their competition-arm slot during Roll-In Throws, Rocker Throws, and Walking-Windup Throws. All of the principles for the drills remain the same, the athlete simply adjusts the angle thrown from. For Pulldowns, sidearm pitchers should throw out of a ¾ slot to maximize intent while also getting somewhat close to their competition-arm slot.

Lastly, it's going to be hard for many sidearm pitchers to actually long toss because they don't put enough backspin on the ball to allow it to travel farther distances. Some athletes will be more comfortable long tossing from a sidearm slot than others—do not force long toss on athletes that do not feel comfortable trying to throw the ball far distances from a low arm slot. Instead, allow the athlete to play catch at a comfortable distance, gradually increasing their RPE% as they throw, similar to how athletes with a standard arm slot would in an actual long-toss progression.