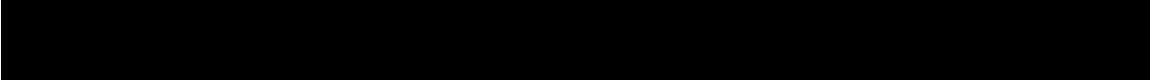




CONTROLLING THE ECCENTRIC FORCES OF A LINEOUT THROW



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Throwing the ball into a lineout is essentially a closed skill. The multitudes of aspects that make up the action of the throw, are primarily repetitive. The stance, grip on the ball, body movement and the arm action should stay consistently repetitive. For this action to become automatic, the thrower needs to practice under strict supervision, so the neurological pathway which is laid down between muscles and brain, is correct in the core movements.

This paper is an explanation of how a coach or player can breakdown the throw and try to understand all features of the throwing action, with a desire to reduce eccentric forces. Firstly it must be stated that later explanations of mechanics and of the throw, all revolve around a desire to reduce eccentric forces. This isn't the only way a football can be thrown.

It must be recognized that the lineout starts from when the ball crosses the sideline. This is the time the thrower must begin to prepare for the throw. The same way a tennis player prepares for a serve after he/she has won or lost the previous point. He/she must relax, control their breathing and begin to go through a pre-programmed preparation routine. The throwing process can be divided into three main sections, which open up into a checklist, that a player or coach can follow to understand all aspects of this very complex closed skill.

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|------------------------------|--|
| 1, Preparation for the throw | <ul style="list-style-type: none">- Breathing techniques- Positive talk- Visualisation- Verbalisation- Concentration- Aiming the throw- Physical actions |
| 2, The Mechanics | <ul style="list-style-type: none">- Direction- Accuracy, Consistency and Trajectory<ul style="list-style-type: none">SpeedAngle- Rotation on the ball- Application of Force |
| 3, The Throw | <ul style="list-style-type: none">- Hand Position and Ball Stability- Stance and Foot Placement- Wrist and Arm Actions- Ball Position- Starting Position and Throwing<ul style="list-style-type: none">Actions- Elbow position- Follow Through |

Later the checklist will be expanded to address each point, therefore making it easier to identify where a throw maybe going wrong.

The human body is made up of a very complex co-ordination system that works on counter action balance and body tension processes. Due to the bipedal make up of the human body all movement involves eccentric forces – we propel ourselves first from one side then the other. In lay terms an example of this is walking. To generate forward propulsion you move your right leg forward, there is a shift in the point of balance and your left arm comes forward to resist rotation around your spin. This action is learnt, as the two-handed lineout throw has to be learnt.

Keeping the above in mind and the lineout throwing laws, regarding the ball being thrown straight, any long rotation (eccentric) through the hips or shoulders needs to be minimised or resisted. The two-handed lineout throw is an activity where both arms must be used in conjunction with each other. Players must learn to use body tension and joint control through their lower body to control the eccentric forces. The body (feet, hips and shoulders) must be kept facing towards the target. If there is any rotation through the feet, hips or shoulders the chance of a crooked throw is increased, as the arms will follow the rotation. To maintain this body tension the muscles of the torso must be controlled. Working in conjunction with the torso must be a strong base or foot contact. If the base is weak or there is movement, the hips will rotate increasing the chance of error. To minimize rotation a solid foot contact pre and post throw is preferable. This will increase the chance of error if you step into or out of a throw before the ball is released. Without the solid base you increase the chance of eccentric forces and therefore the chance of error.

A beginner or somebody who is inefficient at performing this skill, will often allow the body to react as they throw rather than keeping tension across the joints of the body. The result will often be an increase of eccentric forces, which will ultimately increase directional error and decrease forward propulsion. If accuracy is to be maintained then a lineout thrower must learn to throw from a solid base and control body tension across the hips and torso. As movement begins from the starting position, which is described later in this paper, both sides of the body must work together. As the large muscles down the front of the body contract bringing it forward from its braced starting position. The gluts, lower and central core must remain stable to resist any rotation around the spin.

PREPARATION FOR THE THROW

The first thing that a player needs is to develop a Pre-Throwing routine. In practice any throw, which is made, should be done in identical fashion. The same mental and physical routine should be used so the thrower can go through his/her checklist. Doing this will pre-program the throw and its routine, into the throwers mind, so that in a game the thrower shouldn't have to remember all aspects of the throw, as a mental program will

have been installed at training. The clearer the routine and the better the coaching with regard to detail, the more automatic the pre-programmed pathway will become (throw).

There are many techniques that a thrower can use :-

- 1, *Breathing Techniques*: As soon as the ball crosses the sideline throwers need to relax, calmness is essential. Long slow breathing can achieve this and is a good way to prepare. Three breathes maybe enough with shoulders relaxing as each expel each breath.
- 2, *Positive Talk* : A thrower can use positive talk to prepare for the throw, all needed is with a few one line comments that will bring alert their attention to the throw. Some examples are :-
I've done this hundreds of times and seceded,
My throwing action is solid and we have a fantastically well organized lineout.
- 3, *Verbalisation* : The thrower verbalises the action of the throw, an example:
lob ball at two, it needs to land on the jumpers head and clear the forward defense at two. This technique can be used well with positive talk.
- 4, *Concentration* : This technique blocks out the other team. The thrower stares down the centerline and sees only his/her tea m. The thrower should only concentrate on his/her own team. Combining this technique with visualisation can develop a very strong mental tool.
- 5, *Aiming the throw* : As the thrower aims they can be ticking off a mental checklist. As he/she takes aim, looking down the long axis of the ball, whilst moving into the ready position a thrower may verbalise and visualise the throw.
- 6, *Visualisation* : To use this technique the thrower must be able to get a mental picture through thought. An example: The thrower might see themselves throwing the ball, they could see the ball traveling through the air with perfect spin, or a great catch with perfect timing and trajectory.
- 7, *Physical Actions* : The thrower may roll the ball off his hand to practice the wrist and finger action, like a spin bowler would in cricket. This can also be used with a combination of the above techniques.

Whatever combination of mental and/or physical preparation is used there is one thing that stands above all else. The thrower needs to be relaxed and the pre-throwing routine must supply this relaxation. This preparation needs to be practiced every time a lineout is called and football is thrown. This will allow the body to recognize the movement and thought patterns during a game, when the mind could be otherwise preoccupied. The earlier the body recognizes these cues the faster it will adjust to the pre-programmed pattern that has been laid down at training.

MECHANICS OF THE THROW

Direction:

It's essential that the ball travels where you direct, it to go or as the law states, down the center of the lineout. There are five factors that significantly contribute to the accuracy of direction :

- 1, The line of propulsion must be identical to the center line of the lineout. From the starting position behind the head the ball must travel on the same plane that the center of the lineout is on.
- 2, The propulsive force must travel through the central mass of the ball.
- 3, Foundations of the thrower need to be stable. Any eccentric force will increase the chance of error.
- 4, All moving parts of the throw need to be insync and flow smoothly.
- 5, The stability of a thrower's wrist and the ball in his/her hand will greatly effect direction and accuracy of a throw.

Accuracy, Consistency and Trajectory:

For a lineout to be accurate it must have the correct angle of release. The correct angle can be achieved when there is a solid base; no flexion of the hips, minimal eccentric forces and the long axis of the ball is in line with the throwing direction. Tension and stability through the central core will insure that eccentric forces are resisted. If there is flexion of the hips the body will fall forward and the intended shoulder angle ultimately changes, changing the angle of release.

The speed of release is as important. The concepts of a constant build up of speed starting from the large muscles in the legs, applying force through a full range of motion will develop greater control and forward propulsion.

Accuracy needs also to be consistent and consistency only comes with correction where required and practice. The correct practice can be broken down into different types :-

- Mental Rehearsal and Practice
- Mass Practice
- Variable Practice
- Distributed Practice

Whichever of the above practice methods are used they also need to simulate game like scenarios.

The right trajectory is achieved when the correct angle and speed of delivery allows the ball to arrive at the point of the catch. Remember that a throw may have to travel over the opposition's hands and down into the waiting hands of his/her team's jumper (ie: backwards jump at four). Solid foundations, body stability and joint tension are essential if an accurate, consistent throw with the right trajectory is to be thrown.

Rotation on the ball:

The rotation on the ball or the torpedo effect provides the thrower with deception. Rotating the ball makes it travel faster. In basketball the dominant hand provides all the spin whilst the non-dominant hand just supports. There are a couple of differences in the lineout throw. The direction of the rotation is the first. As you look from behind the thrower (right handed), the ball rotates around the long axis from right to left, thus being labeled the 'Torpedo Throw'. The other is that the non-dominant hand should provide some of the torpedo rotation if the body's eccentric force is to be kept to a minimum. As the dominant hand provides the downward spinning action on the ball the non-dominant hand (thumb) should react in the opposite way, providing rotation. The result should be resistance in eccentric forces on the body.

If the non-dominant hand is released early and the dominant hand provides all rotation, there is a possibility that the dominant hand will undercut the ball. This will cause the body to rotate because the arms of the thrower will follow through across the centerline of the lineout.

One of the downfalls of the one handed throw is this undercutting of the ball, producing eccentric forces.

Application of Force:

(see also The Throwing action)

The core application of force should be consistent and repetitive for all throws. Minor adjustments should be made to suit the different varieties. The legs, abdominals, shoulders, arms, wrist and finally the fingers all play a role in contributing to the force. The elbow (see also Elbow position) is above shoulder height and pointing at the intended top arc of the throw, acting like a fulcrum. This will provide a reliable lineal plane to transfer force.

The degree of force and distance over which the force is applied both contribute to the speed of the throw. The knees, legs and abdominals need to be programmed to consistently react during a throw. This movement when adjusted properly can provide stability, smoothness, direction, distance and power.

THE THROW

Hand Position and Ball Stability:

There is a variety of hand positions that can be used to hold the ball stable before and during the throw, most importantly the two hands are diagonally opposite each other. A right handed thrower will have his/her dominant hand (right) placed on the right hand side, from the center to the back of the ball, with the long axis of the ball facing down the center of the lineout. The fingers and upper palm of the dominant hand are rapped evenly around the ball. The thumb is supporting the ball in the hand so that the fingers may remain on the side of the ball and not underneath. Support of the ball is it's only use in the throwing action. The non-dominant hand (left) is placed on the left hand side, from the center to the front of the ball. The fingers and thumb are used in the throwing action; they react to the dominant hand.

The hand placement must be conducive with the mechanics (force/rotation) of the throw. It must also be noted that, the further towards the end of the ball the hand position is the harder it is to control this is due to the dominant hand undercutting the throw.

Stance and Foot Positioning:

The stance or base of the throw is vitally important to whether the body can resist eccentric forces. The most biologically sound foot placement to prevent eccentric forces is parallel or just offset (5cm). Offsetting the feet must be kept to a minimum it should never exceed a distance that starts to turn the hips away from the desired target. Body weight should be evenly distributed over both feet, which are shoulder width apart, creating a solid base of support. Feet, knees, hips, chest, shoulders, and the head should be kept facing the target.

The throwing action is initiated by a slight bend of the knees to assist in balance and a contraction of the large muscles down the front of the body to generate forward movement. Throwers need to learn the concepts of body and joint tension whilst throwing. Foot contact must remain until the ball has left the throwers hands. If the throwers back foot for example comes off the ground, the linear movement of the throw will be broken and rotation around the spin will occur.

Wrist and Arm Action:

It is important in the starting position that controlled tension be maintained across the wrist joint. A thrower shouldn't let the wrist of the dominant hand fall backwards allowing the long axis of the ball to point towards the sky. If this happens it must be corrected during the throwing action or the chance of under cutting the ball is greatly increased. Some players will also allow the wrist to tilt to the right (right handed thrower) when in the starting position. This usually occurs because of a lack of flexibility, as the thrower is aligning/positioning the elbow. The outcome of this is an undercutting of the

throw due to the difficult positioning of the hand and fingers, not allowing an easy rotation on the ball.

Elbows and forearms should be kept above the shoulders, pointing towards the top arc of the throw. The forearms should follow the line of the throw as the triceps contracts.

Ball Position:

As a thrower is moving into his/her starting position, the ball should move directly over his/her head, with the long axis of the ball aligned towards the target. A stable ball position that is kept aligned, before and during a throw, has a greater chance of stability on release. Players often get the ball to the starting position behind the head, with excellent body tension, a solid stance, hips, and shoulders facing the target. Then the elbows are squeezed towards the mid-line. If the dominant hands elbow is squeezed in too tight, it can cause the ball to come off its desired line behind the head. If not corrected during the throwing action the long axis of the ball will now be pointing away from the target. Therefore maintaining ball stability will be difficult during the throw, increasing the chance of directional error.

As there are a variety of hand positions the exact elbow position will vary between throwers. A coach must be aware, that due to the diagonal placement of the hands on the ball the elbows placement doesn't need to be even with regard the mid-line. A thrower's shoulder flexibility will govern how far back his/her ball position should be. The more flexible a thrower is the greater the ability to control the elbow position.

Starting Position and Throwing Action:

Considerable changes have occurred to the lineout in the past five years. It is now evident, that the opposition be given as little time to react to the throw as possible. The starting position of the thrower should now be with the ball behind the head, ready to propel it forward. If there is a backward swing/movement then the opposition has more time to react.

As discussed in the section on foot placement and stance the base of support needs to be solid with no movement. There is a slight curve backwards in the throwers back waiting to come forward when the throwing action begins. The gluts, lower and central core should be 'switched on' providing stability and joint tension. Abdominal muscles should be relaxed in a long position following the shape of the back, ready to be used like a spring during the throw. The ball placement is directly behind the head with the long axis of the ball aligned with the throwing direction. Shoulders and scapular should remain relaxed with the elbows and chest pointing towards the intended target. Many players may find that the dominant hands elbow (see Elbow position) won't close in as far as the opposite arm. This is due to the distance and hand placement on the ball. Wrists should be solid holding the ball in the aligned position. The line of sight needs to be at the top arc of the intended throw, whilst being straight down the centerline of the lineout. A thrower should see his/her team move in their peripheral vision and shouldn't be distracted from their line of sight.

Whilst the players in the lineout are arranging themselves ready for the lineout to begin so to must the thrower. Both parties need to pre-arrange a signal of readiness so that the timing is precise. The thrower's body position, as discussed above, is wound up in readiness to release. On commencement of the lineout the throwing movement should remain consistent and repetitive with minor adjustments being made to allow for the variety of throws needed. A slight bend in the knees will assist in balance and is a good way to initiate the throwing action. The large muscles down the front of the body contract, starting with the legs. Abdominal muscles are used, as springs to bring the body forward like a high tensioned piece of steel. If this action is refined and done properly they can supply stability, direction, speed and power to a throw. A thrower must be made aware that there is no flexion of the hips. As this will cause a change in the shoulder and release angles, ultimately effecting direction and distance of the throw. There must be a body awareness that will allow the force supplied by the legs and abdominal muscles to travel up through the body and into the shoulders and arms not forward. The shoulders should transfer this momentum as they rotate forward. The triceps will straighten the arms and add power while the elbow should stay pointing at the desired target acting as a fulcrum.

The thrower's wrists remain controlled with effective joint stability, not allowing any flexion or extension. Hands and fingers rotate the ball with a push – pull action. The dominant hand pulling down on the seam of the football (being careful not to undercut the ball) and the non-dominant hand reacting, pushing the ball in the opposite direction to counter act the eccentric forces.

The stance (foot position) should remain the same. Body tension shouldn't be relaxed, the throwers body follows the line of force up through the shoulders and arms. The line of sight remains the same, towards the top of the arc of the intended throw.

After the ball has left the hands and the body extended into the follow through, the thrower should then step forward into the field, alert and ready to react to the next play.

Elbow Position:

From the starting position the elbow should be used like a fulcrum, transferring energy into the forearms, hands and finally the ball. If the elbow isn't aligned with the axis of the throw then movement may occur during the throwing action, making it very difficult to control both the angle and speed of release. A thrower who has poor flexibility will find it difficult to align their elbow with the intended throwing line, producing a problematic throwing action. The ball position in this case should be brought forward (above the head) to a point where a thrower can adjust their elbow position, allowing for a more conducive throwing action.

The elbows should have a good bend and be pointing at the top of the arc of the intended throw. As a thrower goes through his/her action the elbow should remain above shoulder height, this will allow the energy/force that has been generated from the throwing action to be relayed through the ball towards the target.

The Follow Through:

As with all throwing sports, the follow through is an extension of the throwing action. The correct follow through of any throwing action should be in the direction of the target. If the follow through is pulling a thrower to the left or right, this is a clear indication that somewhere in the throwing mechanics is an eccentric force that is unbalanced, causing the body to react in this manner. The use of the abdominal muscles in the throw may cause a player to fold forward at the hips in the follow through. This problem is caused by a flexion (see also Throwing Action) of the hips. Players need to be aware that the body must stay up and flow into the height of the throw. The body awareness that a thrower needs to use his/her abdominal muscles like a spring and learn to relay the energy/force up the body into their shoulder, arms and the ball is a difficult skill. If body tension is relaxed the result will be a forward follow through. The same will happen if a thrower allows their head to drop (look at their teammates) rather than keeping the line of sight on the top arc of the throw. Throwers must learn the concepts behind a constant build up of energy and the transferal of energy through the body in the throwing action. Throwers should keep the height of the throwing action in the follow through, allowing the energy to be released at its intended target.

Checklist

- Foot Position / Stance
- Balance / Weight Distribution
- Hand Position and Grip
- Hips / Shoulders Square
- Body tension
- Back position / Abs starting position
- Shoulders relaxed
- Aim
- Chest / Elbow position
- Ball Position and Stability
- Wrist
- Line of sight
- Relax
- Slight Knee bend
- Leg and Abdominal muscles
- No Hip Flexion
- Shoulder rotation and triceps
- Energy Transferal
- Hand movement
- Follow through

Whatever checklist
you use as a coach or player,
the ability to minimise
eccentric forces to a point where
they doesn't exist,
still remains the most
important and influencing
fact in the accuracy and
consistency of a lineout
throw