

FOOTBALL INJURY PREVENTION

Football is the sport traditionally associated with knee ligament injuries. We are all aware of the seriousness of the knee injury produced by the classic clip.

The injury prevention techniques discussed in this paper relate to the anterior cruciate ligament. The anterior cruciate ligament is one of the major stabilizing ligaments in the knee. Without a functional anterior cruciate, athletes are unable to participate in sports, develop degenerative arthritis and must maintain lifetime restrictions in order to extend the life of the knee. When torn in the young athlete, the anterior cruciate requires surgical reconstruction and restricts the athlete from any participation for one full year. Because of this, it is important that athletes should be informed of measures they can take to prevent them from tearing this ligament. A recent analysis of our data, that combined several sports, excluding North American football, indicates that 89% of all anterior cruciate tears occur without a direct hit at the knee. This football data shows that 50% of the injuries to the anterior cruciate in football occur **without** contact, while 49% had contact at the knee. This type of injury often involves the “blue chip” player with exceptional running ability.

Most injuries to the anterior cruciate ligament involve one of three main injury producing situations (plant and cut, straight knee landing, one step stop) and often includes a combination of these. The load which injures the anterior cruciate ligament results from the posterior slope of the patellar tendon when the knee is between the position of straight to 30 degrees of flexion. This causes extreme loads on the anterior cruciate ligament, when the quadriceps muscle contracts, as the knee is near straight. This is why all injury prevention instruction covered in this paper, emphasis is placed on **bending the knee**.

1. Plant and Cut

The plant and cut may combine a sudden decelerating maneuver with a twisting movement that can further load the anterior cruciate ligament causing a tear.

2. Straight Knee Landings

When coming down from a jump, the player who lands stiff legged or does not continue to bend his knees as he lands is very likely to damage his anterior cruciate.

3. One Step Stop

This is a sudden decelerating movement with the knee near straight that place the ligament in a dangerously tight position and often ends in a tear of the anterior cruciate. **Decelerating in one step or with the knee near straight, is dangerous.**

Our purpose is to define the play situations where this injury is most likely to occur and demonstrate improved player technique which not only improves the player's performance but also decreases the risk of knee injury.

I. TURNING

ACCELERATED ROUNDED TURN TECHNIQUE

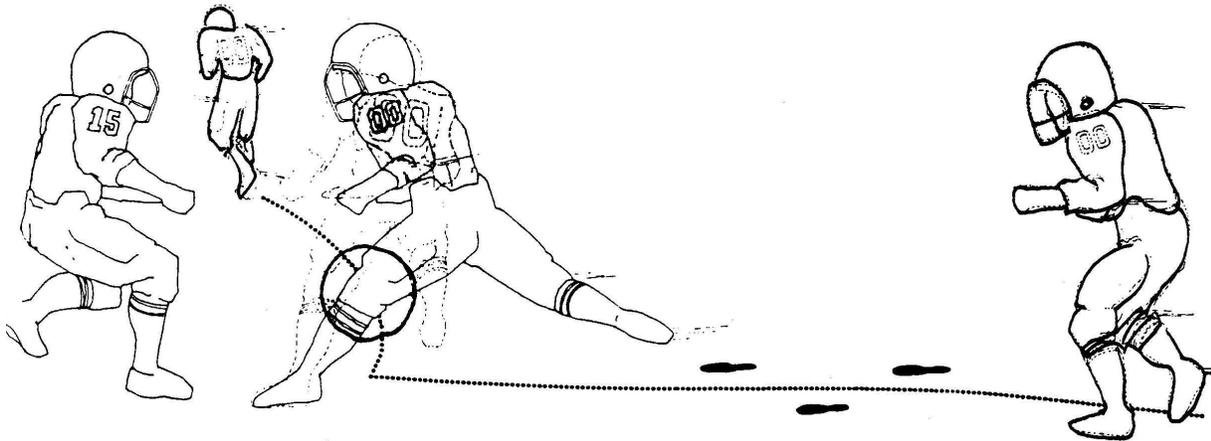
The program is begun by learning proper rounded turn technique. The turn is actually begun with the **inside foot**, not the **outside foot**. That is the foot **towards** the direction of the turn, not the foot **away** from the turn. This is called the preparation step. The turn is continued on the outside foot with the player feeling like he is accelerating through the turn. It is obvious that when you are accelerating you cannot be decelerating. **Remember decelerating is dangerous.** Many of our players say the words out loud “inside-outside” as they are proceeding through the turn. This helps with proper technique in the turn.

Turning...Running Injury Producing Situation Plant and Cut

Often, an offensive player will be placed in a situation requiring him to make a directional change in order to avoid the defender. If done incorrectly this may result in an injury to the anterior cruciate ligament. The next picture illustrates the improper technique that involves a plant and cut move on the outside (left) leg. Although the player may have made this move many times with no resulting injury, the move loads the anterior cruciate ligament to the point close to failure. Only a slightly harder effort with the same move will result in a tear of the ligament. A lot of the athletes we see have stated, “I have done this many times with no injury but this time I planted a little bit harder”, or “this time I twisted a little more.” This little difference in the way they normally make their move is all it takes to tear the ligament. Anytime an athlete makes a turn or change of direction must remember to **KEEP HIS KNEES BENT AND HE MUST NOT PLANT ON THE OUTSIDE LEG. THIS MOVE IS A HIGH RISK MOVE AND WILL TEAR THE ANTERIOR CRUCIATE LIGAMENT IF DONE WITH TOO MUCH FORCE.** If the proper technique cannot be performed in the turn, the athlete must option to go straight ahead. It is unsafe to ever make a plant on the outside leg to make a turn.

Note that the outside (left) knee is straight which increases the chance of tearing the anterior cruciate ligament. This not only loads the anterior cruciate, but it slows (decelerates) the player to almost a complete stop. This, in combination with the position of the outside leg, causes the player to lose one full step on the defender. Often one step can mean the difference between an important completion and an interception.

Injury Producing Situation



Note: (1) Player sprints towards the defender, (2) and plants an outside (left) foot involving a deceleration. (3) Player loses one full step on the defender.

Improved Player Technique Accelerated Rounded Turns

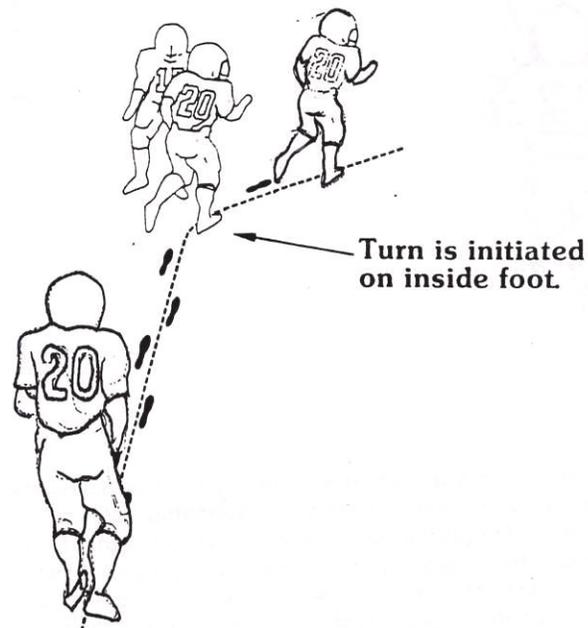
You can practice accelerated rounded turns in pass pattern situations. The receiver should begin by running straight at the “inside” shoulder pad of the defender and initiate the turn between six to eight feet away from the defender with your inside foot. As the turn is established you accelerate through the turn to run the “out pattern”. As you accelerate through the turn you separate yourself farther from the defender and reduce the risk of interception or being hit as you first touch the ball resulting in an incompleteness. Remember to accelerate through the turn and make the turn with multiple steps.

The key to making a good move on the defender is to approach the defender head on a steady pace and accelerate past him making your turn in multiple steps. If you approach the defender at full speed and then try to get past him, you have lost the element of surprise acceleration. By adjusting your speed to allow for a slower more steady approach, and then using acceleration to make your move, you have the element of surprise on your side. Another key thing to remember when making a rounded turn is to approach the defender straight on. Don't lean as you make your approach as this will show the defender which way you are turning. It is acceptable to incorporate a head fake with this but you should be careful not to extend and plant on the outside leg.

The next picture demonstrates an offensive player approaching a defensive player. The offensive player is controlling the ball but must get past the defender. He approaches the defender at $\frac{1}{2}$ to $\frac{3}{4}$ speed. When he is ready to make his move, he will accelerate past the defender. To do this he should make his preparation step on the inside foot, pump his arms as he rounds the turn, and accelerate past the defender. He

may incorporate a head fake as he approaches the defender by dipping his left shoulder as he pushes the ball towards the right and makes his turn off the inside (right) leg. This maneuver is done at a much lower risk of injury than the “plant-and-cut”, move.

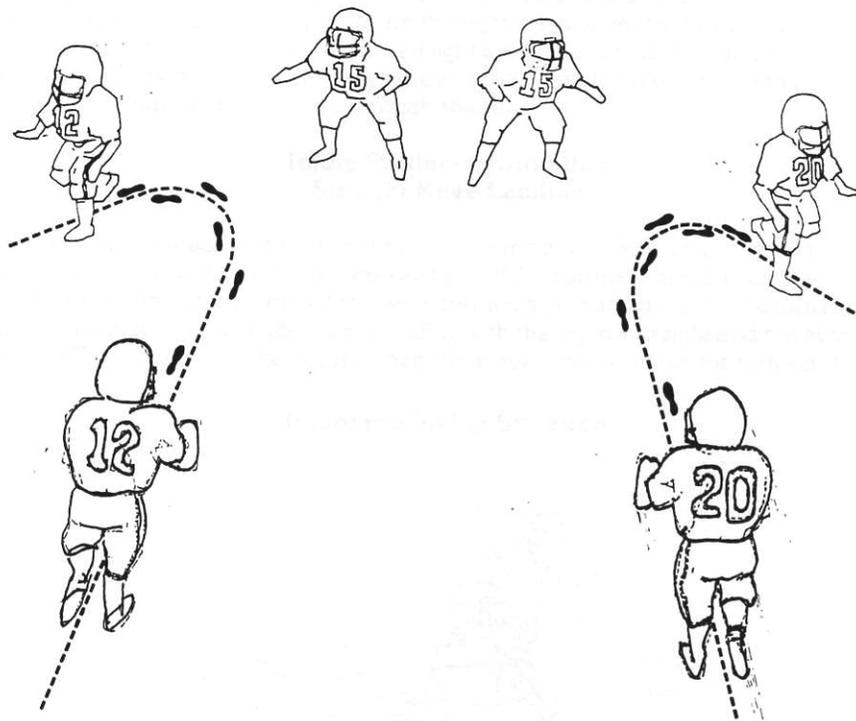
Improved Player Technique



Note: (1) Speed should be $\frac{1}{2}$ - $\frac{3}{4}$ of accelerated speed at turn. (2) Do not lean into the turn, make a straight approach. (3) A head fake may be done by dipping left shoulder. (4) Preparation is made on inside foot. (5) Accelerate through turn.

The curl pattern is made by combining two “inside-outside” turns and breaking down. You must expect the ball waist high. The play is begun by sprinting straight at the inside pad of the defender to keep him honest about going long and then making the multiple step turn with good control.

Improved Player Technique



The running back can simulate a broken field situation by placing cones on the field and running rounded, accelerated turns past these simulated defensive players. Remember to enter the turn under control and accelerate through the turn. A good running back will spend the majority of his running in the up field direction. By running at the defender instead of trying to make a lot of lateral cuts across the field, you not only use good running technique, but you also are less likely to encounter an injury to the anterior cruciate. A player that runs with a lot of sharp hard cuts is making a transition from sudden deceleration to acceleration. This is a common injury producing situation involving the anterior cruciate.

II. LANDING BENT KNEE LANDINGS

It is dangerous to land with the knees straight (extended or hyperextended). This places the anterior cruciate ligament under tremendous stress and increases the

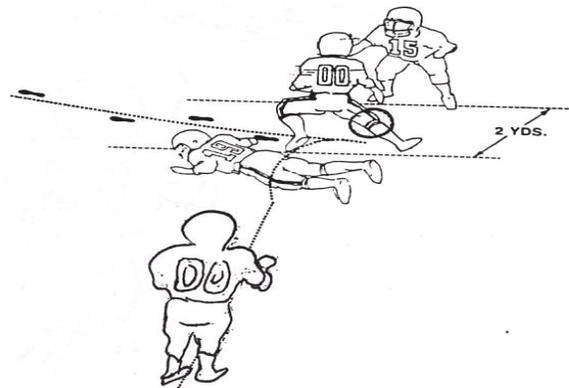
chance of tearing it. If the player lands with the knees bending, it decreases the chance of an anterior cruciate ligament tear. Anytime a player jumps he must land with knees bent, and continue to bend the knees to absorb the impact gradually. The following techniques, i.e. one step, two step landings combine the accelerated rounded turn with the bent knee landings.

When you make a bent knee landing on one leg you should take another step with the other leg before initiating a turn off the inside leg, i.e., if you land on the right leg take another step on the left to initiate a turn towards the left. The first step after landing must be a light touch. Be sure to land on your toe and let your knee bend. Ideally, you must have a two yard landing zone and the second foot on the ground before beginning the turn. Now lean into the turn and accelerate through the turn.

Injury Producing Situation Straight Knee Landing

It is often the case in football that a player is forced to jump over a downed player. Care should be taken to avoid landing on the outside foot and trying to make a turn off the outside foot at the same time. The next picture shows this situation involving a player forced to clear a downed player and try to make a turn to his left in order to avoid a defender. The first mistake made here is landing with the leg too straight and not absorbing the impact from the landing. The second mistake occurs when the player tries to make his turn off the outside leg.

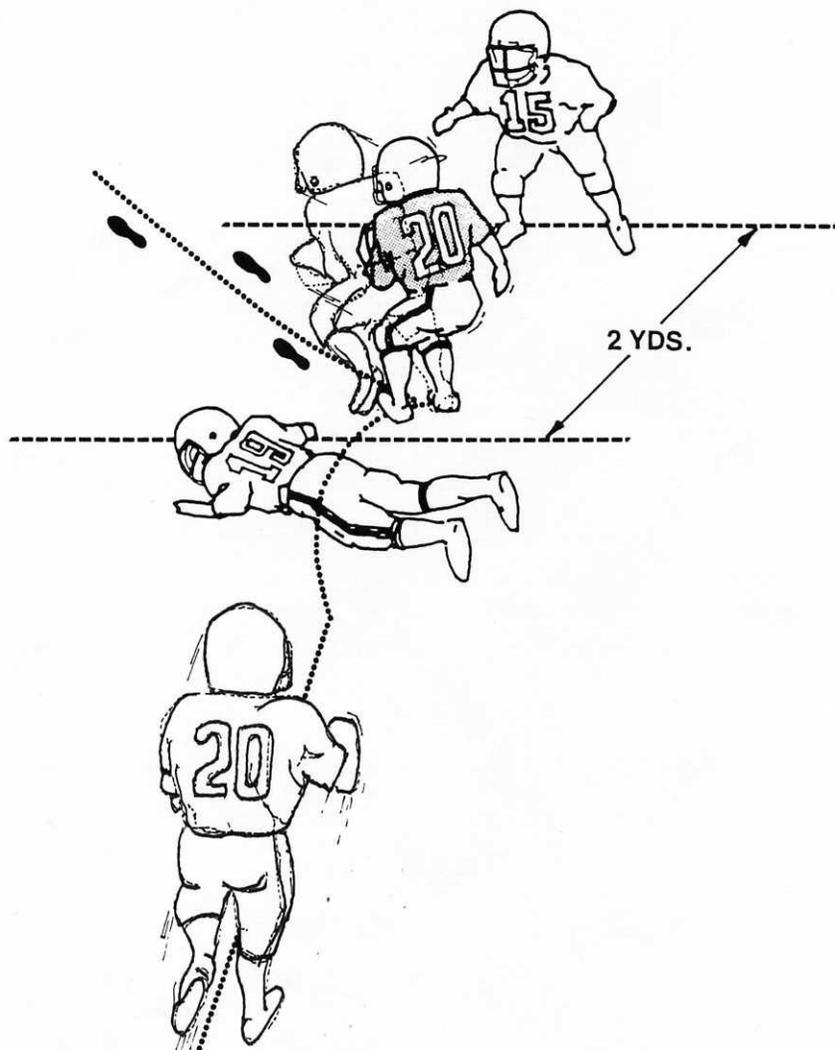
Injury Producing Situation



Improved Player Technique Bent Knee Landing

This illustration shows the correct technique for landing after jumping over a downed player. The player clears the downed player and continues the landing by bending his knees. He then completes the turn by accelerating off his inside foot.

Improved Player Technique

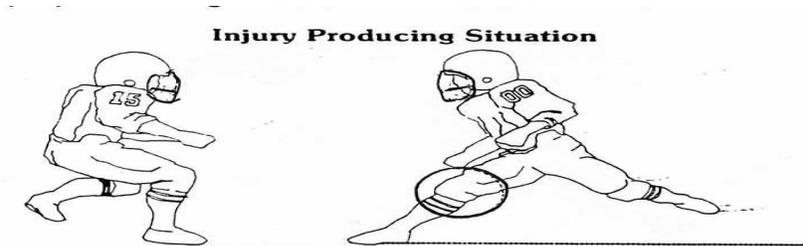


III. STOPPING THREE STEP STOP

The three step stop is used when a player needs to come to a stop, or when he needs to change direction. Imagine the running back who finds himself in a situation that requires him to make a sudden deceleration in order to avoid the defensive players. The improved player technique allows the player to reduce his forward speed, lowering his center of gravity, bending his knees and decelerating in at least three steps. He is now in a position of balance that prepares him for any directional change, or is ready to make an explosive move into the defender.

Injury Producing Situation One Step Stop

Too often a player will decide to make a sudden stop by planting or extending his leg thus placing the knee into a position that will tear the anterior cruciate ligament. This occurs because the knee is not bent and the quadriceps muscle is rapidly contracting.

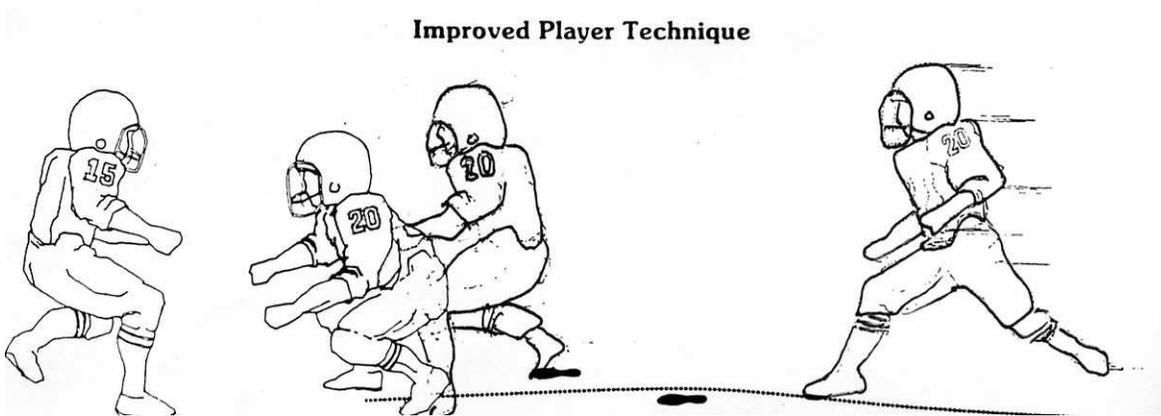


Note: Player attempts to stop in one step which places too much force through right knee. This in combination with the knee being too straight can produce an anterior cruciate ligament tear.

Improved Player Technique Three Step Stop

The next picture shows the improved player technique for coming to a stop. Notice the player slows down in three steps and bends his knees as he slows down. This places him in a well balanced position that allows him to make a directional change.

Improved Player Technique



Discussion

These basic improved techniques can be applied to any playing situation. You must improve your skills by applying these techniques to practice situations. Injury prevention is not limited to these three basic techniques (accelerated rounded turns, bent knee landings, three step stop); however, these are the most common ones we use in our practice. There are other general injury prevention techniques that involve stretching and strengthening that are important but are not discussed in this paper. These techniques will not prevent further injury to a knee when the anterior cruciate ligament has been previously torn.

It is common to see many players with knee braces intended to stop rotational instability. These braces are often used after an anterior cruciate tear in order to attempt to return the athlete to sport. The injury prevention techniques will work only when you have two stable knees. The use of braces does not significantly change the stability of the knee when measured with sensitive arthrometers. It is also well documented that these derotational braces are unsuccessful in protecting the meniscus in the unstable joint. A second problem is the favouring of the injured leg which is enhanced by such a brace. Forty-two percent of the patients presenting to our clinic wearing a brace on their anterior cruciate deficient knee, tore the cruciate in their other knee within two years, after they returned to sports. Statistically, even with a brace, 98% of these players who are playing with an anterior cruciate deficient knee, will tear one or both menisci within one year. By continuing to play after an injury to the anterior cruciate, even with a modern derotational brace, both knees are still at risk. The incidence of a meniscus tear while wearing a brace is likewise not reduced. Thus, we cannot recommend playing with an anterior cruciate deficient knee. Of the athletes in our study, 22% that have torn one of their anterior cruciates, and did not have surgical reconstruction, ultimately tear the cruciate in their other knee when they return to sports.

The meniscus is the cartilage in the knee that provides stability, tracking and padding for the femur and tibia (the thigh and shin bones). When the cartilage is torn, it will deteriorate rapidly (3-5 years), thus leading to early degenerative arthritis. Every attempt must be made to repair the meniscus. If the meniscus is surgically removed, partially or completely, the knee is destined for early degenerative arthritis.

The purpose of explaining injury prevention techniques is obvious. Athletes involved in any sports should be aware of these ideas. It is the responsibility of schools, coaches and parents to convey these skills to athletes promoting safe athletic activities.

Injury Producing Situations for the Anterior Cruciate Ligament
FULL CONTACT FOOTBALL N=120

	Not Hit n=49 = 41%	Hit n=69 = 58%	Total
Running with the ball hit=19, pac=5, tws=4, otr=1	10	19	29=24%
Defensive backfield hit=11, pac=1	1	11	12=10%
Offensive Blocking hit=6, pac=3, hyp=1, otr=1	5	6	11=9%
Kick off team hit=5, pac=4	4	5	9=8%
Going for a pass hit=2 pac=2, skl=2, hyp=1 otr=1	6	2	8=7%
Making a tackle hit=3, pac=2, tws=1. otr=1	5	3	8=7%
Kick off return team hit=3, pac=3, tws=1	4	3	7=6%
Defensive blocking hit=7	0	7	7=6%
Plant and fake (no description) pac=4, oss=1	5	0	5=4%
Hit (no description)	0	5	5=4%
Clipped	0	4	4=3%
No Description pac=2, oss=1, hit=1 2*	1	1	4=3%
Shifting on defense pac=3	3	0	3=3%
Going for a pass (defense) skl=1, pac=1, otr=1	1	1	2=2%
Lead blocking hit=1, otr=1	1	1	2=2%
Punt return hit=2	0	2	2=2%
Jumped over a downed player skl=1	1	0	1=1%

pac= plant and cut = 31, otr = other = 6, tws = twist = 5
 skl = straight knee landing = 4, oss = one step stop = 3, hyp = hyperextended= 2
 OFFENSE=52, DEFENSE=35, SPECIAL TEAMS=18, NOT KNOWN=11, DRILLS=4

*not known if hit or not

Injury Producing Situations for the Anterior Cruciate Ligament

RECREATIONAL FOOTBALL N=34

	Not Hit n=28 = 82%	Hit n=6 = 18%	Total
Plant and fake pac=12, oss=1	13	0	13=38%
Running with the ball pac=4, hit=2, oss=1	5	2	7=21%
Going for a pass pac=4, hit=1	4	1	5=15%
Going for a pass (defense_ skl=2	2	0	2=6%
Trying to stop hit=1, oss=1	1	1	2=6%
Hit (no description)	0	2	2=6%
No description skl=2	2	0	2=6%
Making a tackle otr=1	1	0	1=3%

Pac = plant and cut = 20,
Oss = one step stop = 3,

skl = straight knee landing = 4
otr = other = 1

OFFENSE = 16 = 47%,

DEFENSE = 5 = 15%,

N/A = 13 = 38%

Injury Producing Situations for the Anterior Cruciate Ligament

VARSDITY AND REC. FOOTBALL N=154

	Not Hit n= 77 = 50%	Hit n= 75 = 49%	Total
Running with the ball Hit=21, pac=9, tws=4, oss=1, otr=1	15	21	36=23%
Plant and fake (no description) pac=16, oss=2	18	0	18- 12%
Going for a pass Pac=6, hit=3, skl=2, hyp=1 otr=1	10	3	13=8%
Defensive backfield hit=11, pac=1	1	11	12=8%
Offensive blocking hit=6, pac=3, hyp=1, otr=1	5	6	11=7%
Kick off team hit=5, pac=4	4	5	9=6%
Making a tackle hit=3, pac=3, otr=2, tws=1	6	3	9=6%
Kick off return team hit=3, pac=3, oss=1	0	7	7=5%
Defensive blocking hit=7	0	7	7=5%
Hit (no description)	0	7	7=5%
No description pac=2, skl=2, oss=1, hit=1	3	1 2*	6=4%
Going for a pass (defense) skl=3, pac=1, otr=1	5	0	5=3%
Clipped hit=4	0	4	4=3%
Shifting on defense pac=3	3	0	3=2%
Punt return hit=2	2	0	2=1%
Lead blocking hit=1, otr=1	1	1	2=1%
Trying to stop hit=1, otr=1	1	1	2=1%
Jumping over a downed player skl=1	1	0	1=0.5%

Pac = plant and cut = 51, skl = straight knee landing = 8, otr = other = 7
Oss = one step stop = 6, tws = twist = 5, hyp = hyperextended = 2

OFFENSE=68=49%, DEFENSE=40=26%, SPECIAL TEAMS=18=12%

DRILLS=4=3%, N/A=24=16%

* not known if hit or not