VOLLEYBALL INJURY PREVENTION

Injuries to the anterior cruciate ligament are often associated with contact sports. However, these injuries occur quite readily in noncontact sports such as volleyball and gymnastics. Even in contact sports such as football and basketball injuries to the anterior cruciate usually occur during a noncontact situation. Volleyball is for the most part a noncontact sport. Any contact at the knee in volleyball usually occurs near the net and is almost always between two players on the same team.

The injury prevention technique 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. Football shows that 50% of the injuries to the anterior cruciate occur without contact, while 49% had contact at the knee.

There are three injury producing situations in volleyball, (straight knee landing, one step stop, and plant and cut) and of these three, the straight knee landing is the most common injury producing mechanism. The one step stop is the second most common injury producer followed by the plant and cut. 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 in all injury prevention instruction covered in this paper, emphasis is placed on bending the knee.

1. STRAIGHT KNEE LANDINGS
   When coming down from a jump, the player who lands stiff-legged or does not continue to bend his knee as he lands is very likely to damage his anterior cruciate. This most often occurs when landing from a spike or a block and not allowing both knees to bend. It also occurs when a player tries to land off balance on one leg.

2. ONE STEP STOP
   This is a sudden decelerating movement with the knee near straight that places the ligament in a dangerously tight position and often results in a tear of the anterior cruciate. Deceleration in one step or with the knee near straight, is dangerous.

3. PLANT AND CUT
   The plant and cut may combine a sudden decelerating maneuver with a twisting movement that can further load the anterior cruciate causing a tear. This type of injury usually happens in sports that require a player to elude a defender such as a running back, in football who makes a plant and cut move to avoid a tackle. In volleyball it is
rare that a player make a plant and cut move except to plant and push off to make a
sudden move to one side. It is still important to be aware of this technique.

Our job 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. LANDING
BENT KNEE LANDING

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 bent and continues to bend them
as he lands, he decreases the chance of an anterior cruciate ligament tear. Anytime a
player jumps, he must land with the knees bent, and continue to bend the knees to
absorb the impact gradually. Volleyball players must utilize the bent knee technique
and avoid the straight knee landing. The events most common to anterior cruciate
injury in volleyball are spiking and blocking. In almost all cases, the history is clinically
the same. The individuals land off balance, or on one leg following an attempted spike
or block. Our data indicates the majority of the injuries to the cruciate occur in pre-
game warm-ups when the players are practicing their spikes. These players are not
using good technique as they do in a game. Instead, they are simply hitting the ball as
hard as they can and are not in control. This can be avoided by using good technique
in pre-game.

In spiking situations, there are two major contributors to knee ligament injury, the
first being the approach by the spiker and the second being the position of the set.
When approaching the net, the spiker must keep the ball directly in front of him and use
a breakdown or bent knee technique, both for the take-off and the landing. Common
errors are to take off on one leg, attempt to get a set not directly in front of you, or to
land on one leg off balance as the result if improper positioning as you hit the spike.
Another injury producing situation that occurs on a landing is having your spike blocked
hard at the net forcing you off balance. Whenever landing, it is important to remember
that your knees must bend so that your thighs are almost parallel to the floor. This
will greatly diminish the possibilities of knee ligament damage plus allow you to get a
greater height on a continuation of the jump if the ball is either blocked or tipped. If the
second situation arises or a poor set occurs, you must have the court sense to play a
free ball deep into the court or dink the ball. In addition, it is improper to use the drill of
running from the back line to the front line position to spike in practice. This often
results in an injury. The following picture shows a player approaching the net for a
spike.
Injury Producing Situation

Note: The incorrect positioning of the ball which forces the player to land off balance stressing the anterior cruciate.

Landing...Blocking

The second most common injury producing situation involving a landing, is landing from a block. In most cases the injury occurs when two players attempt a block at the same time, as the picture below demonstrates. The player’s partner bumps the player who comes down off balance and sustains a knee ligament injury. A powerful spike can also cause the blocker to land off balance in a possible injury producing situation.
**Injury Producing Situation**

![Image](image_url)

*Note: As the player lands he fails to bend his knees which loads the anterior cruciate ligament.*

**Improved Player Technique**  
**Bent Knee Landing**

Resolution of this problem is quite simple in that all landings must be knee-bent to minimize the risk of hyperextension and they must continue to bend to absorb the force of impact. The following picture illustrates the improved player technique for a bent knee landing. Note the player is being bumped by his teammate while attempting a block. The bumped player is knocked off balance with his knees bent as opposed to the injury producing straight knee landing.
II. STOPPING

THREE STEP STOP

The second most common injury producing situation is the one step stop. Anytime a player is forced into a situation that requires him to make a sudden stop or change direction, it must be done in at least three steps. This technique minimizes the stress placed on the anterior cruciate from sudden deceleration.

Stopping....Save
Injury Producing Situation
One Step Stop

Imagine the player chasing a ball out-of-bounds. This player will attempt to make a sudden stop by extending his leg, in order to return back to play. This is often combined with a twisting movement in order to change direction. The twisting movement and the extended one step stop, are a high risk by themselves but when combined together they increase the risk of tearing the ligament. The following picture shows an example of a typical injury producing situation involving a ball being pursued out of bounds.

Injury Producing Situation

Note: The player extends his leg in order to stop in one step and tears his ligament.
Improved Player Technique

Three Step Stop

The problem is resolved with one of two techniques. The first technique is using the three step stop, allowing your knees to bend so your thighs are parallel to the floor and making the stop in three steps. At that time you can back peddle or turn and return to the court of play.

The other option is to run a half circle using the rounded turn technique (see Accelerated Rounded Turns in next section). Both of these take about equal amounts of time, and interestingly enough take no more time than the plant and cut. Both of the improved player techniques mentioned, allow the player to return to the court under control and ready to play a ball that may be returned in their vicinity.

The next illustration shows a player using the three step stop technique to retrieve a ball out-of-bounds.

Note: The bent knee technique of the player as he comes to a stop in three steps. He then plays the ball.

III. TURNING

ACCELERATED ROUNDED TURN TECHNIQUE

The last injury prevention technique discussed is the accelerated rounded turn. This is not emphasized as much in volleyball as it is in other sports because this maneuver is primarily used to avoid a defender in sports such as basketball, football, and soccer. Many times a player in one of these sports will attempt to make a turn on a defender by making a plant and cut. A plant and cut is a high risk move that is done by extending one leg to make a sudden stop and then pushing off on that
same leg to make a cut in the opposite direction. This move is done at a very high risk and for most sports is the highest injury producing mechanism. Instead of making a plant a cut move, an athlete should incorporate the rounded turn to make sudden directional changes. This calls for a player to make the turn off the inside leg (the leg nearest the direction of the turn) by bending the knees and accelerating through the turn.

**Injury Producing Situation**

**Plant and Cut**

![Diagram of a volleyball player making a plant and cut move.]

*Note: The poor starting position the player uses as he begins his approach. A good defensive, bent knee position should be used which would allow him to push off with his knees bent.*

**Improved Player Technique**

**Rounded Turn**

In order to make a directional change such as in the above situation, a volleyball player should start each play in a good defensive, bent knee position which allows a quicker and safer preparation for any directional change. By starting the play in a bent knee position you have greater control of balance and agility. The next picture illustrates a player making a directional change utilizing a defensive, bent knee technique and combing that with an accelerated rounded turn. The key to making a safe move is to **keep the knees bent** and **avoid pushing off with the outside leg**. This player is making a move to his **left** and is pushing off with his **left** leg. This is a much safer move than the plant and cut and can be done just as effectively.
This technique of making rounded turns can also be used for the player pursuing a ball out-of-bounds. Instead of planting one leg to return back after bumping the ball, a player should either use a three step stop or a rounded turn. The rounded turn is done by accelerating through the turn using short choppy steps with the knees bent. This allows the player to make the directional change in a shorter distance than they would using a long stride which would result in a wide turn and is safer than the plant and cut.

**Discussion**

It is an underestimation to think that players who compete in volleyball are not at risk to tearing their anterior cruciate ligament. Although it is a noncontact sport, keep in mind that 95% of all anterior cruciate ligament tears occur in a noncontact situation excluding football. By using improved player techniques we can avoid a large majority of serious knee ligament injuries.

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 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 derotation 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 after an injury to the anterior deficient knee, will tear one or both menisci within one year. By continuing to paly 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 not changed in the injured knee, and the risk of tearing the anterior cruciate ligament in a good knee 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

VOLLEYBALL N= 28

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<tr>
<td>Jumping for the ball</td>
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<tr>
<td>Block shot attempt</td>
<td>4</td>
</tr>
<tr>
<td>Dig</td>
<td>3</td>
</tr>
<tr>
<td>Landing from a jump</td>
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</tr>
<tr>
<td>Bump play</td>
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<tr>
<td>Landed on someones foot</td>
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<tr>
<td>Stop to jump</td>
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<tr>
<td>Injury situation not known</td>
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Not Hit = 28 = 100%

Hit = 0