METHODS FOR SCREENING AND PREVENTING COMMON INJURIES IN DIVISION I BASKETBALL PLAYERS

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There are several different screening tests and exercises that may help identify underlying issues that can lead to common injuries seen in National Collegiate Athletic Association (NCAA) Division I basketball players. This article will focus on the common injuries seen in basketball players, effective screening protocols, prevention exercises, and training methods that can be used to identify potential risk factors associated with injuries and potentially prevent these common injuries from occurring in Division I basketball players.

INJURIES

Basketball, like most sports, has become a year-round sport in the United States. As a result, by the time these athletes get to the college level, many of them are already suffering from musculoskeletal imbalances. This may be, in part, due to an overspecialization in their sport without proper strength, conditioning, flexibility, mobility, and soft tissue training programs in place to help prevent or correct these imbalances. Research has shown that the majority of injuries in college basketball for both men and women are lower extremity injuries (1,5). Of these injuries, some of the most common ones include patellar tendinopathy, inversion ankle sprains, and anterior cruciate ligament (ACL) tears.

PATELLAR TENDINOPATHY

Patellar tendinopathy, or "jumper's knee," is one of the most common injuries in both male and female collegiate basketball players. Patellar tendinopathy is a chronic overuse injury that usually comes with anterior knee pain along the patellar tendon. It can be acute or chronic and may lead to a decrease in performance. Research has suggested that, amongst other factors, decreased range of motion (ROM) in ankle dorsiflexion, tight quadriceps and hip flexors, inadequate lower body strength, and poor landing mechanics may lead to an athlete developing patellar tendinopathy (2,10).

INVERSION ANKLE SPRAIN

An inversion ankle sprain occurs when the foot rolls inward underneath the ankle or leg. While the evaluation and rehabilitation of an inversion ankle sprain is not within the strength and conditioning coach's scope of practice, there are ways for the strength and conditioning coach to help the athlete make a successful return. Research has found a correlation between chronic ankle sprains and hip abduction weakness on the involved limb following an acute inversion ankle sprain (6). This finding suggests that the strength and conditioning coach may want to improve hip abduction strength to prevent inversion ankle sprains.

ANTERIOR CRUCIATE LIGAMENT TEAR

The ACL is located in the middle of the knee joint and its main purpose is to limit the amount of forward translation of the tibia relative to the femur. An ACL tear can occur in a number of ways, including non-contact hyperextension when decelerating, landing, or changing direction. Studies have shown that properly balanced strength ratios (particularly between the quadriceps and hamstrings) and the introduction of neuromuscular and proprioceptive exercises into a strength and conditioning program can help to prevent ACL tears (3,9).

SCREENING

Overhead Squat Test (Figures 1 and 2)

The overhead squat test assesses range of mobility, symmetry, and function at the ankles, knees, hips, pelvis, and thoracic spine. The test begins with the athlete standing barefoot, with their feet shoulder-width apart, toes straight ahead, and a dowel rod placed on their head with the elbows bent at a 90-degree angle. The athlete then locks their elbows out and squats as low as they can in a controlled motion. If they are unable to squat below the point where their thighs are parallel with the floor, then they can elevate the heels to allow for greater ankle ROM. Where an athlete's overhead squat movement breaks down can be revealing about what type of musculoskeletal imbalances they have and what injuries they may be at an increased risk for getting. Many basketball players struggle with this test due to limited ankle dorsiflexion, limited thoracic spine extension, and tight hip flexors (4).

FIGURE 1. OVERHEAD SQUAT TEST

FIGURE 2. OVERHEAD SQUAT TEST

Thomas Test (Figures 3 – 5)

The Thomas test is used to test tightness in the hip flexors and differentiate hip flexor tightness between the iliopsoas and rectus femoris. Many basketball players have tight hip flexors and this test helps to identify if tightness exists in both muscles or if it is localized to one muscle, as well as helps determine disparities between the limbs (7). This test begins with the athlete on a training table or bench with both legs tucked up towards the chest. The athlete releases one leg at time letting the hip fully extend while holding the opposite leg in place near the chest. Downward pressure can also be added to the extended leg to help determine tightness and flexibility.

FIGURE 3. THOMAS TEST

FIGURE 4. THOMAS TEST

FIGURE 5. THOMAS TEST

Drop Landing Test (Figures 6 – 8)

The drop landing test is useful for looking at an athlete's landing mechanics and any injuries they may be at risk of developing based on their landing mechanics. The test begins with the athlete standing on top of a box (a 24-in. box is recommended for most athletes). The athlete is instructed to step off the box and land softly with both of their feet hitting the floor at the same time. A useful coaching cue is to instruct the athletes to transfer their weight from "ball to the heel" and "push the hips back" as they land. They should also avoid letting their knees come together.

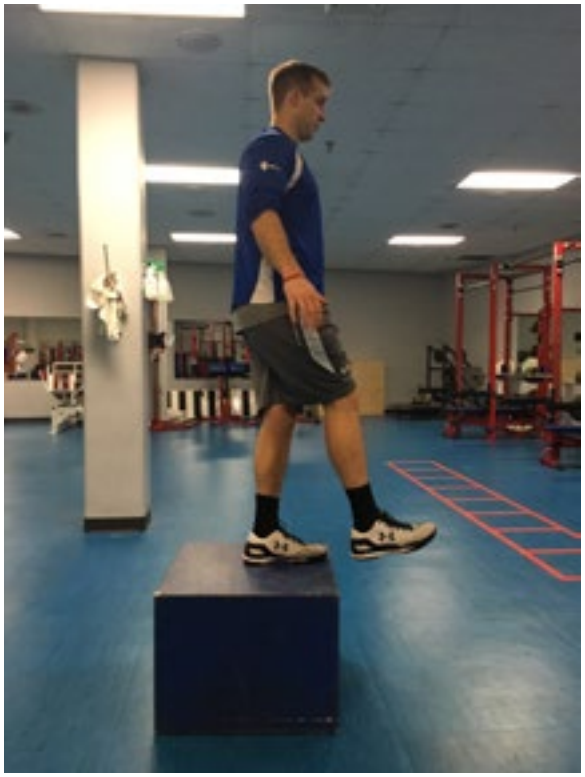

FIGURE 6. DROP LANDING TEST

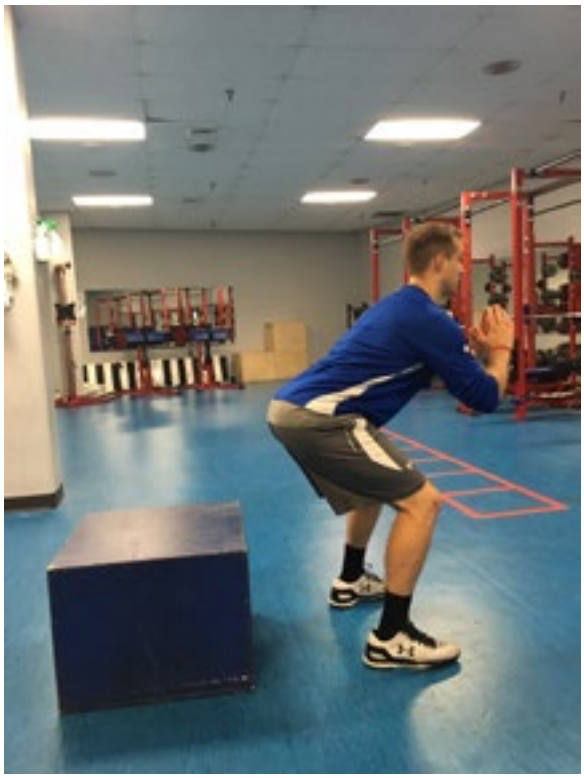

FIGURE 7. DROP LANDING TEST

FIGURE 8. DROP LANDING TEST

Active Straight-Leg Raise Test (Figures 9 and 10)
The active straight-leg raise test assesses active hamstring flexibility while maintaining a stable pelvis. The test begins with the athlete lying supine on the floor with their toes pointed up. Slowly and under control, the athlete will lift one leg up as high as possible with the active leg straight, while the opposite leg and low back remain flat on the floor. If the athlete's active leg does not stay straight or if it cannot reach a point where it is perpendicular to the floor, then there could be hamstring or plantar flexor tightness. If the opposite limb lifts off the floor, or the pelvis moves into an anterior tilt, then the hip flexors on that limb are most likely tight (4).

FIGURE 9. ACTIVE STRAIGHT-LEG RAISE TEST

FIGURE 10. ACTIVE STRAIGHT-LEG RAISE TEST

Single-Leg Hop for Distance
The single-leg hop for distance test is used to assess symmetry in strength and power between lower limbs. It is commonly used following ACL reconstructive surgery to evaluate the rehabilitation process by providing an objective measure for return to play. To perform the test, the athlete stands on one leg and jumps as far as they can, but they must land properly. Three attempts are given and the average of the three attempts is the final score. If there is a difference of more than 10% between limbs, then there is likely a disparity between the limbs, making the athlete more susceptible to injury (8).

Triple Single-Leg Hop for Distance
The triple single-leg hop for distance test is also used for assessing functional symmetry in strength and power between lower limbs. The athlete performs three successive hops on one leg and must land correctly in order for the score to count. The grading criteria is the same as the single-leg hop for distance test, with a 10% difference between the limbs being the cutoff (8).

PREVENTION

After gathering information regarding an athlete's injury history and completing the appropriate screening, strength and conditioning coaches can develop an exercise program to help prevent the likelihood of an injury. The following are stretches and exercises that can be used to help prevent the injuries mentioned earlier and to help correct the imbalances discovered during the tests and screens if implemented into a training program appropriately.

STRETCHES

Bulgarian Hip Flexor Stretch (Figures 11 and 12)

This stretch has two techniques and targets both the rectus femoris and iliopsoas. To stretch the rectus femoris, the athlete places one foot on a bench behind them with the top of the foot facing down. The athlete takes a step out and puts the rear knee down on the floor (or padded surface). Next, the athlete pushes their buttocks onto the rear foot and lifts their arms over their head.

To target the iliopsoas with the Bulgarian hip flexor stretch, the athlete takes an exaggerated step out after putting the rear foot on the bench with the top of the foot facing down. Then, the athlete holds a split squat without letting the knee touch the floor to best of their ability. The arms are also placed over the head.

FIGURE 11. BULGARIAN HIP FLEXOR STRETCH

FIGURE 12. BULGARIAN HIP FLEXOR STRETCH

Wall Ankle Rocks (Figures 13 and 14)

This stretch primarily targets the Achilles tendon and soleus muscle. It begins with the foot elevated on a slant (a tri-stretch device or small weight plate may work) so that the toes are elevated above the heel. While keeping the heel flat on the slant or plate, the athlete rocks the knee forward medially over the big toe and laterally over the little toe. The athlete can use a wall for balance and support. Each rock is held for one second before returning to the starting position. Perform one set of 10 repetitions in each direction for each foot.

FIGURE 13. WALL ANKLE ROCKS

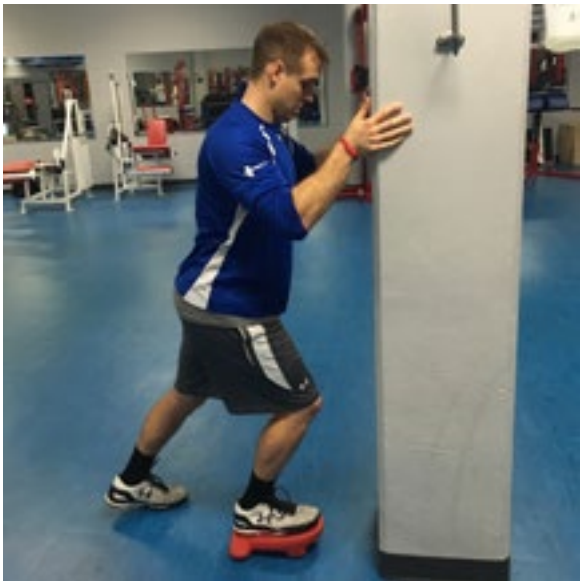

FIGURE 14. WALL ANKLE ROCKS

Two-Part Lunge (Figures 15 and 16)
The athlete begins by stepping into a forward lunge and attempting to reach the ipsilateral elbow to the floor while keeping the back leg as straight as possible. After holding for one second, the athlete places both hands on the ground and straightens the front leg out. After holding for one second, the athlete steps forward with the opposite leg and repeats the same movement for the desired number of repetitions.

RESISTANCE EXERCISES

Pistol Squat on Bench (Figures 17 and 18)
The exercise begins with the athlete standing on one leg. Slowly and under control, the athlete sits back while maintaining the alignment with the knee and toes until they reach the bench. The athlete pauses for a second on the bench and then stands back up using the same leg, returning to the starting position. This exercise helps teach the athlete to track the knee over the toes without letting the knee move anteriorly over the toes. It works the quadriceps and gluteals of the working leg. This exercise can be used in all phases of the off-season and in-season as a warm-up/activation or in the exercise routine itself.


FIGURE 15. TWO-PART LUNGE


FIGURE 17. PISTOL SQUAT ON BENCH


FIGURE 16. TWO-PART LUNGE


FIGURE 18. PISTOL SQUAT ON BENCH

Dumbbell Single-Leg Romanian Deadlift (Figures 19 and 20)
The athlete begins by standing on one leg with the opposite knee slightly bent and in the air behind the body. Slowly and under control, the athlete flexes the hips keeping the hips square and the dumbbells close to the thighs. The athlete pauses at the bottom position with their back flat and parallel to the floor with the opposite leg flat and parallel to the floor as well. The athlete returns to the starting position while maintaining a rigid torso. This exercise is great for athletes with weak hamstrings, spinal erectors, and gluteus maximus muscles. This exercise can be used in the preparation and endurance phases of the off-season or in the in-season.

Trap Bar Deadlift (Figures 21 and 22)
This exercise begins with the athlete standing with their feet shoulder-width apart inside the trap bar. To get into the starting position, the athlete pushes their arms and hips back like they are going to perform a vertical jump, grabbing the bar at the bottom of the motion. From there, the athlete pushes the shoulder blades together and puts the spine in a neutral position. When looking at the start position from a lateral viewpoint, the shins should be near vertical, the hips should be higher than the knees, the torso should be rigid, and the spine should be neutral. Slowly and under control, the athlete drives through the heels with the hips and torso rising at the same time. The athlete finishes by extending the hips and knees fully to come to an erect, or standing, position. The athlete then lowers the bar under control to the floor. This exercise is great for developing the hamstrings, glutes, and erectors while placing minimal stress on the knee joints. The trap bar deadlift can be used in all phases of the off-season and in-season.

FIGURE 19. DUMBBELL SINGLE-LEG ROMANIAN DEADLIFT

FIGURE 21. TRAP BAR DEADLIFT

FIGURE 20. DUMBBELL SINGLE-LEG ROMANIAN DEADLIFT

FIGURE 22. TRAP BAR DEADLIFT

Dumbbell Bulgarian Split Squat (Rear Foot Elevated Split Squat) (Figures 23 and 24)
The exercise begins with the athlete's rear foot on top of a bench behind their body. The athlete then takes a step out with the lead foot away from the bench. With the weight on the front heel, the athlete lowers their body under control until the front thigh is parallel to the floor. The athlete then drives through the front heel and returns to the starting position. This exercise can be loaded in a variety of ways, not just dumbbells, and can be used in all phases of the off-season and in-season.

Buddy Hamstrings (Nordic Curls) (Figures 25 and 26)
This exercise begins with one athlete kneeling on a pad and a partner holding his ankles. With the torso and hips in a neutral and erect position, the athlete slowly falls to the floor maintaining the rigid posture with their hands out ready to absorb the impact of falling. When the athlete's hands touch the floor, they immediately push back to the starting position with as little upper body force as possible, relying on the hamstrings to pull the torso back up. It is important that the rigid posture is maintained throughout the exercise to avoid injury and emphasize the hamstrings. This exercise is great for developing eccentric hamstring strength and can be used in all phases of the off-season and in-season.

FIGURE 23. DUMBBELL BULGARIAN SPLIT SQUAT

FIGURE 25. BUDDY HAMSTRINGS

FIGURE 24. DUMBBELL BULGARIAN SPLIT SQUAT

FIGURE 26. BUDDY HAMSTRINGS

EXERCISE PROGRESSION

Progressing from the drop landing to a depth jump to a depth jump to box exercise can help to teach the proper biomechanics when landing and jumping, as well as helping with the rate of force development. Depending on the athlete's mechanics, strength, and power, it is advised to spend about 4 – 6 exposures in each progression before moving on to the next but appropriate progression will vary between athletes.

Drop Landing

Much like the drop landing test, the athlete starts on top of a box (18 – 24 in.) and steps off the box, landing as softly as possible. The feet should land simultaneously, with the weight being transferred from the balls of the feet to the heels, while pushing the hips back to absorb the impact rather than letting the knees move anteriorly. It is important that the athlete lands with the hips higher than the knees as gradually bending the knees will teach the athlete to dissipate the force. The athlete holds this landing for a two-count before standing and returning to the box for the next repetition. It is important that the knees track in line with the toes and do not collapse inward.

Depth Jump

After demonstrating proficiency in the drop landing, the next progression is the depth jump. Like the drop landing, the athlete starts on top of a box and steps off the box, landing as softly as possible. Immediately after contact is made with the floor, the athlete then jumps vertically as quickly as possible, minimizing the contact time with the ground. It is important to note that while emphasis is placed on minimizing ground contact time, the jump should not be so fast that they do not land properly or cannot apply enough force into the ground to jump vertically. After jumping vertically, the athlete should land the second time in the proper landing position with the weight being transferred from the balls of the feet to the heels and pushing the hips back to absorb the impact. The athlete holds for a two-count before standing and returning to the box for the next repetition.

Depth Jump to Box (Figures 27 – 29)

After demonstrating proficiency in the depth jump, the next progression is the depth jump to box. Like the depth jump, the athlete starts on top of a box and steps off, landing as softly as possible. Immediately after contact is made with the floor the athlete then jumps onto a second box as quickly as possible. Minimizing ground contact time is still a point of emphasis in addition to the landing mechanics on the second box. The athlete should land with the same mechanics as in the first two progressions; this exercise can lose its efficacy when the second box is so high that proper landing mechanics can no longer be achieved.

FIGURE 27. DEPTH JUMP TO BOX

FIGURE 28. DEPTH JUMP TO BOX

FIGURE 29. DEPTH JUMP TO BOX

CONCLUSION

Basketball is a physically demanding sport that requires physical preparation to be successful at the highest level. Strength and conditioning coaches should investigate methods to identify potential risk factors associated with injury. From properly gathering this information, strength and conditioning coaches can create individualized strength and conditioning programs to help keep their athletes healthy and performing at the best of their abilities.

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