Coaches and Physical Therapist’s Methods in Decreasing Knee Injuries

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ABSTRACT

Knee injuries in colligate athletes is a concern and raises the question if coaches should utilize conditioning programs to help prevent knee injuries. The direction of this research is to find what programs will help decrease the risk of knee injuries and uncover whether coaches are aware of conditioning concepts that may help address injury prevention measures. Concepts such as preventative conditioning programs to help decrease knee injuries among athletes, and how coaches could utilize physical therapy concepts to assist in a quicker recovery will be addressed in the following materials. These coaching strategies could help increase awareness of structural components of the knee and what factors contribute to knee injuries.
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**Introduction**

Knee injuries in colligate athletes is a concern and raises the question if coaches should utilize conditioning programs to help prevent knee injuries. Hensch (2007) cited that one in 100 female high school athletes will injure their anterior cruciate ligament in a given sports season. As the research by Hensch (2007) indicated a high ratio of knee injuries in high school, female athletes it would seem that ratio would increase in college sports due to the greater intensity. Concepts such as preventative conditioning programs to decrease knee injuries among athletes, and how coaches utilize physical therapy concepts to attain a quicker recovery will be addressed in the following materials. The correlation between physical therapy concepts and colligate coaches conditioning programs may be the needed link to decrease knee injuries. The direction of research was to find what programs will decrease the risk of knee injuries and uncover whether coaches are aware of conditioning concepts that may help address injury prevention measures.

The strategies that coaches implement in their conditioning programs or practices should be geared towards injury prevention. The following materials address how coaches and physical therapy concepts could motivate and encourage collegiate athletes after a major knee injury as well as help link physical therapy rehabilitation exercises to the college athlete’s goals of returning to the competition. These coaching strategies could help increase awareness of structural components of the knee and what factors contribute to knee injuries.
**Knee Construction**

The anatomy of the knee has three different bones, muscles and ligaments that contribute to its stability and function. There are three bones that come together to make a complex joint: the femur, the tibia and the patella. The femur has two condyles, (medial and lateral), which have a specific shape corresponding to the shape of the tibia. The shapes of the condyles on the femur and the tibia play important roles in the movement of the knee joint. The condyles of the femur and the tibia plateau have a convex shape which helps for a more secure fit. The function of the medial condyle is to act as a pivot while the lateral condyle displaces posteriorly with flexion, while being guided by the ligaments (Nordin & Frankel, 2012).

Being able to facilitate flexion and extension of the lower extremity at the knee joint is a necessary function for daily living, sports, exercising, and recreational use. The ability to extend the lower extremity into a straightened position is facilitated primarily by the use of the quadriceps. The quadriceps group consists of four muscles located on the anterior side of the thigh. The four muscles that make up the quadriceps are the rectus femoris, vastus intermedius, vastus lateralis, and vastus medialis. The patellar bone has a specific location which creates a great mechanical advantage when extending the knee. “The patella provides an important biomechanical function in the knee by lengthening the lever are of the quadriceps muscle force about the center of rotation of the knee and thereby increasing the mechanics and efficiency of the quadriceps in all” (Hehne, 1990, p. 200).

Flexion is the motion that causes the lower extremity to bend at the knee joint. During flexion of the knee the posterior muscles are used. These muscles include bicep femoris, semiteninosus, and semimembranousus, which are referred to as the hamstring muscles. When extending, the quadriceps are contracted which then pulls the patella to straighten the knee.
When the quadriceps’s become relaxed the leg moves into flexion with the assistance of the hamstrings that bend the leg further in the motion (Partners, 2010). To keep the knee a stable joint while performing extension and flexion, the use of ligaments controls this. The strength and stability of the knee is assisted by ligaments, which are strong bands that are not flexible and attach bone-to-bone. Around the knee joint there are four main ligaments that help stabilize the knee: The medial collateral ligament (MCL), the lateral collateral ligament (LCL), the anterior cruciate ligament (ACL), and the posterior cruciate ligament (PCL). The MCL attaches to the medial side of the femur to the medial side of the tibia and the function is to limit sideways motion of the knee (Nordin & Frankel, 2012). The LCL attaches to the lateral side of the femur to the lateral side of the fibula and functions to limit sideways motion of the knee. The ACL attaches the femur and the tibia in the center of the knee, which is deep within the knee joint. The function of the ACL is to limit rotation and forward motion of the tibia (Nordin & Frankel, 2012). The PCL attaches the tibia and the femur and is also the strongest ligament. The location of the PCL is behind the ACL in the middle of the knee. Its function is to limit the backwards motion of the knee (Nordin & Frankel, 2012). Refer to Appendix A for a diagram of the knee.

**Differences between Male and Female**

Injuries can happen to a player at any point throughout their sports season. An individual’s body structure can depict whether or not they are more prone to injuries. “Women are 4-6 times more likely than men to experience an ACL tear” (Bise, 2012, p. 1). According to Hewett, Zazulak and Myer (2007) women are at higher risk compared to men because of neuromuscular control imbalances in women. Women go through a menstrual cycle which creates a large fluctuation in female sex hormones during the stages of puberty. Hormones affect musculoskeletal function by slowing muscle relaxation and increasing the muscle fatigue during
the ovulation stage of the menstrual cycle (Hewett, Zazulak, & Myer, 2007). Hewett et al. (2007) cited that estrogen was directly related to female knee injuries because of the affects that estrogen had on tensile properties of ligaments. Estrogen and female sex hormones in females create major problems for muscle performance in sports. As a result of the imbalances in hormones during puberty, there are significant differences between males and females. Women have delayed hamstring reaction and faulty knee mechanics when jumping and landing. Research has shown that females rely on their quadriceps more for deceleration more than males (Nitka, 2005). In women, the hamstrings are slower to react which allows for greater stress to be applied on the ACL (Nitka, 2005). According to Hensch (2007) there are four main reasons that women are at a higher risk for knee injuries. Women have smaller intercondylar notch in the knee, where the ACL passes through the joint. First women have smaller and narrower knees it takes less stress to tear ligaments in a female knee compared to a male. Women also have wider hips and tend to rotate them which can put women at a higher risk than males (Hensch, 2007). Hensch’s (2007) research showed that hormonal differences also put women at higher risk. Another reason women are at a higher risk than males is that females tend to bend their knees less during the athletic movement needed during different sports. With women bending their knees less than males, they will also land flat-footed more whereas males have a more soft landing (Hensch, 2007). Some of the aspect such as hormonal and anatomical factors is unavoidable but programs can address the neuromuscular control to help decrease knee injuries among athletes.

**Programs to Reduce Knee Injuries that Coach’s Utilize**

Programs that coaches utilize can be beneficial for the team’s progress throughout a given season. Coaches have to prepare their athlete’s bodies so the athletes will be less prone to injuries. Many coaches utilize certain programs that are sport specific, but also utilize
conditioning programs that are injury specific such as knee injury reduction programs. According to Wakeham (2003) coaches first strategy when doing a conditioning program specifically designed for females is to strengthen the full body. During the program the coach needs to pay close attention to the gluteals, quadriceps, abductors, hamstrings, and calves. Strengthening these muscles “will counter deceleration forces, decrease the forward movement of the shin bone, assist in keeping the knee in a stable position and help influence safe postures in sports movements” (Wakeham, 2003, p. 64). When female athletes use the weight room certain exercises help with the strengthening of the muscles such as squat, forward and lateral lunge, forward and lateral step-up, and a weighted pulley or band circuit (Wakeham, 2003).

Wakeham (2003) evaluated many different injury prevention programs and then made his own version called The Spartan Program. This program combines strengthening, balance, and dynamic sport performance movements. Athletes begin the workout with a dynamic warm-up. This will get the body primed and ready to start the other exercises that are challenging. After his dynamic warm-up he uses dynamic exercises which he emphasizes teaching the athlete body control and body awareness during acceleration and deceleration movements in different directions (Wakeham, 2003). The strengthening of Wakeham’s programs starts out with lower body lunge matrix. The matrix is six rotations of the knee in three different planes. A total of eighteen lunges are performed, and then an additional two more rotations are added with the arms stretched above the head to establish a more difficult lunge while giving the abdominal a great stretch. At the end of the matrix workout he incorporates hopping and has his athletes hop in three different directions. When wanting to make it difficult he has the athlete close one or both eyes while turning their head left or right. The next part of the workout consists of lifts such as leg curls and body weight glute and hamstring negatives. Another strengthening portion is
when the athletes perform a static bridge while alternating hip flexions. The last part of the workout consists of single leg balance drills (Wakeham, 2003). A big portion of knee prevention that he provided to his athletes was education on how to land, where the knee should be located when land and how to land softly and when decelerating from sprinting to use multiple small steps which will help initiate the gluteals and hamstrings to help with decreasing forces on the knee (Wakeham, 2003).

Another study conducted by Nitka’s (2005) showed that plyometric training can help decrease knee injuries in female athletes. The hamstring-quadriceps ration can be improved with the right supervised plyometric and strength training program. When developing his program it is a progression through jumping drills and throughout the drills correct the faulty mechanics that the athlete may have so then the athlete will do the exercise correctly to minimize the risk of knee injuries (Nitka, 2005). Nitka’s program started out with a warm-up like a bike ride or a light run followed by lower extremity stretching to increase blood flow to those muscles and prepares them for activity. The routine that Nitka (2005) suggested is the use of low-intensity to high-intensity jumps. Sample of his progression are jumping in place, standing jumps, bounding, multiple hops and jumps, box jumps. When increasing the intensity the athlete has to demonstrate control and proper technique. To increase the intensity of the jumps he adds variation and distance to each jump (Nitka, 2005).

Injury prevention is key for a coach to implement in their program for an upcoming season. “ACL injury prevention training strategies mainly focusing on warm-up, technique, balance, strengthening, and agility exercises have continued to evolve and represent an ever-increasing and equally important research focus” (Benjaminse & Otten, 2010, p. 622). Injury prevention is more than exercising and keeping the body in fit condition, the athlete needs to
become aware of knee control during different states of movement. When using a program that is to develop neuromuscular control the coach needs emphasis on the knee over toe position (Benjaminse & Otten, 2010). The theory behind neuromuscular training focuses on cues, technical feedback, and visual feedback. The neuromuscular conditioning program can enhance the learning of the motor skills of the athlete only on external focus of attention, which means they can focus on the movement effect where as internal focus of attention focuses on movement themselves (Benjaminse & Otten, 2010). The problem with consciously having an athlete focus on their own movements might interfere with their normal, automated performance, which may lead to a crash in the natural coordination of movement.

**Physical Therapy Concepts**

After a major knee injury, one of the most important professionals that an athlete will encounter is the physical therapist. When treating an athlete, physical therapists are presented with unique challenges that require them to assess the injury site and then design a post-operative or post-injury treatment plan for a full recovery and return of the athlete to their competitive sport activity. Coaches will communicate with the physical therapist to understand what stage the athlete is at so the coach can utilize the physical therapy concepts to help with a fast and safe recovery. During the first stages of the rehabilitation process the athlete is under the direct care of the physical therapist. During the first stage of the athletes recovery, the main focus is on the healing of the knee, the therapeutic exercises at this point are usually performed manually by the physical therapist and are very limited (Clark, 2011). The second stage focuses on stretching so that full range of motion is restored and this is still very limited with the physical therapist manually assisting the patient with motion and functional activities. Stage three, is where coaches are able to assist the athlete with exercises that are designed to help with the
rehabilitation of the athlete as well as to incorporate some higher functioning activities such as; high-speed drills, plyometric activities, and sport specific exercise in their conditioning programs (Clark, 2011). Post injury conditioning concepts, that coaches may want to focus on, are the physical therapy long term goals which may include restoration of knee stability, functional range of motion, and return pre-injury activity level in a pain-free state. By focusing the recovery conditioning program on the physical therapy long term goals the chances of re-injury or a new injury may be minimized (Medvecky, Zazulak, & Hewett, 2007).

**Methods**

Structured interviews were conducted utilizing pre-determined questions (Appendix B) that were approved by the University of Wisconsin-Superior Institutional Review Board (IRB). The significance of this study helped increase safety concepts related to 18-24 year old collegiate athletes and knee injuries. This research was designed to help find a correlation between physical therapist’s concepts and what coaches actually have their athletes do during conditioning programs to help decrease the percentages of knee injuries. The data that was collected comes from interviewing 9 coaches. The results to the questionnaire were categorized and assessed to determine what the coaches’ perceptions are. The data outcome was utilized to either support or not support this author’s hypothesis that physical therapy stability programs if incorporated with conditioning programs would decrease knee injuries.

**Results**

After interviewing coaches with pre-determined questions the following percentages were extracted from the data. 8 out of 9 coaches agreed that the ACL was the most common knee injury that coaches encounter in their careers. Following ACL injuries, 4 out of 9 coaches agreed that MCL was the second most common knee injury. 7 out of 9 coaches have included, specific
to their sport, a conditioning program or preventative means to reduce athlete’s injuries. 5 out of 9 coaches stated their conditioning programs focus on strengthening the muscles along with agility and speed. 8 out of 9 coaches agreed that females are more prone to knee injuries, while 3 out of 9 coaches were able to give at least one reason why females are more prone to knee injuries. 6 out of 9 coaches agreed they would benefit from having open communication with a physical therapist about injury prevention and rehabilitation. All coaches stated that there was no communication between themselves and physical therapists.

**Discussion and Recommendations**

As previously stated, knee injuries are on the rise, which generates the question if coaches are utilizing appropriate programs and physical therapy concepts that may help reduce knee injuries. This study showed what some coaching programs have been established, what is incorporated into those programs which have made them successful and what physical therapy concepts that coaches can utilize to provide for a more stable program to help reduce the increase in knee injuries. The author has supplied research that females are more prone than male athletes in the occurrence of having a knee injury in their sports career. The research conducted has begun to assess how knee injuries could be decreased in collegiate athletes but much more research can be engaged in to further enlighten both coaches and athletes. Because females are more likely to have a knee injury, if the research was done on just females, there could be a better understanding of what coaches could utilize to help reduce knee injuries. The recommendations that the author has for coaches are they need to incorporate the physical therapy concepts into their condition programs and be more engaged in researching professional concepts that could be utilized to prevent and help recover from injuries of the knee.

**Conclusion**
Should coaches utilize conditioning programs to help prevent knee injuries? This question should raise awareness for athletes who want to be able to have a long successful career in a particular sport. Coaches need to establish the correct program(s) to assist in preventing injuries of their athletes. These program(s) should be assessed by a physical therapist to help aid in knowledge for the players and coaches. If coaches would utilize physical therapists they could build a program and assess throughout the years to determine the effectiveness of their program(s). Keeping athletes less prone to injury benefits everyone on the team.
References


Appendix A

(Nordin & Frankel, 2012, p. 181)

*This is a picture of the knee, showing all of the ligaments and condyles*
Appendix B

Questions:

- What’s the most common knee injury that you treat in ages of 18-24 years old?

- What type of strategies are coaches doing to help decrease knee injuries?

- What are the 5 milestones to rehabilitation of the knee injuries?

- How are physical therapists informing coaches of preventative measures to the injuries?

- What are physical therapists/coaches to motivate and encourage after a major knee injury?

- How are physical therapists/coaches engaging the athlete to continue rehabilitation?

- Do the structural components of the knee contribute to knee injuries and is there a difference between Male/female?

- New surgical technology that helps with the recovery process or the surgery itself.