Reducing ACL Injuries by Implementing the PEP Program

Educating coaches and players about the benefits of PEP program to reduce ACL Injuries

Tag Words: ACL Prevention, PEP Program, ACL Injury, Nutrition, Sleep Patterns

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Summary

ACL injuries are the most common injury that women’s soccer players now face. In order to fix this routine that is now so evident in the women’s game, steps must be taken to ensure that players are doing the appropriate ACL prevention. By introducing the PEP program to women’s soccer players, the likelihood of suffering from an ACL injury is decreased. After talking with Dr. Arent (Exercise Physiologist) we also found that the time of day a team trains can indirectly affect susceptibility to injury through factors such as nutrition and sleeping habits.
The Issue: ACL Injuries

Introduction
There are many different aspects of the college atmosphere that make up Rutgers University. One of the factors that lead many students to come to this school, of course besides the educational value, is athletics. Despite critiques of over-emphasis for certain sports, it cannot be denied that Rutgers athletics brings in a lot of publicity, money, and increases enrollment at the University. Therefore, it is important to keep our athletes healthy so that we can be successful both on the athletic fields and in the classroom, in order to bring more prestige to an already exceptional academic institution. The issue of injury prevention is one that all sports teams need to be aware of and take every measure decrease. Specifically, we will be discussing the Rutgers Women’s Soccer team and using this group of girls as an example of how injury prevention can affect a program.

The women’s soccer team at Rutgers has been plagued with an epidemic of players tearing their ACL’s. Despite enjoying great success within the past four years by making it to an NCAA sweet sixteen, Big East Championship, and achieving national ranks within the top ten, the girls have had to face a lot of adversity with seven ACL tears in the last three years, including a staggering four in the first seven games of this past season alone. This type of statistic is atypical and clearly there needs to be a change in order to prevent this type of injury from happening again. Through various types of research including interviews, articles, and essays, it can be concluded that ACL tears can be prevented with the consistent performance of certain exercises, mainly those that focus on strengthening of the muscles around the knee, in particular the hamstrings. “The hamstrings act to pull the tibia backward in the knee. The ACL keeps the tibia from moving forward; therefore the hamstring can protect the ACL from injury” (Junge).

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Injury Type</th>
<th>Frequency</th>
<th>Percentage of Severe Injuries</th>
<th>Most Common Injury Mechanism</th>
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<tr>
<td>Games</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee</td>
<td>Internal derangement</td>
<td>518</td>
<td>44.1</td>
<td>Player contact</td>
</tr>
<tr>
<td>Ankle</td>
<td>Ligament sprain</td>
<td>156</td>
<td>13.3</td>
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<td>Concussion</td>
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<tr>
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<td>36.7</td>
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</tr>
<tr>
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| Practices  |                    |           |                               |                              |
| Knee      | Internal derangement| 245       | 25.5                          | No contact                   |
| Ankle     | Ligament sprain    | 133       | 13.8                          | No contact                   |
| Upper leg | Muscle-tendon strain| 92        | 9.6                           | No contact                   |
| Other     |                    | 491       | 51.1                          |                              |
| Total     |                    | 961       |                               |                              |

Figure 1 demonstrates just how big of an issue knee injuries are in women’s soccer. In both contact and noncontact injuries, internal derangement of knee ligaments holds the most frequency in women’s soccer, out numbering the other injuries by far (Dick).

Every soccer player is aware that an ACL injury is an extremely common injury in the sport of soccer, but many teams across the nation have been proactive in preventing this by implementing ACL prevention program that are closely monitored to ensure the athletes are performing exercises with correct form.
Prevent Injury, Enhance Performance Program

Throughout our research, we have found many models of ACL prevention exercises designed strictly and specifically for females, especially female soccer players, that are proven through vigorous studies and experiments to have a very high success rate. One model of success which stuck out and was mentioned in several articles is the PEP program, which stands for Prevent injury, Enhance Performance. Studies and experiments have shown that this type of program can reduce the risk of ACL injury in women soccer players by almost 88%. It is important to note that this program is a warm-up for athletes to do before practice, which helps to get the body to its optimal core temperature, ensuring that the athletes’ muscles are not only at their strongest to prevent injury, but also to compete at peak performance.

This program has such high statistics of success because it emphasizes core trunk stability, engaging the lateral hip gluteus, and hamstrings to decrease excessive genu valgum and anterior translation of the tibia dynamically. “Biomechanics can be significantly altered in a positive way by participating in a prevention-based program. These programs are very simple to implement.” After a randomized controlled trial to prevent noncontact anterior cruciate ligament injury in female soccer players concluded that “this program, which focuses on neuromuscular control, appears to reduce the risk of anterior cruciate ligament injuries in female soccer players, especially those with a history of anterior cruciate ligament injury” (Gilchrist).

Figure 3 provides some examples of what is exactly performed during the PEP program.

Advantages of PEP consist of the following:

- **Time**- the exercises are not very time consuming, as seen in Figure 3, the exercises only take about 20 minutes and are to be performed 2-3 times per week.
- **Body Awareness**- the program is designed as a warm up, so it will not be performed when the athletes are fatigued and their muscles are already at risk for injury.
- **Evidence**- based- as shown in the studies mentioned above, the PEP program is proven scientifically to decrease the risk of an ACL tear in a female soccer player.

We believe that the PEP program is important because it gives athletes the proper warm-up before competition. A warm-up is paramount in making sure that the athlete is prepared for
practices and games. This program is designed to have the athlete get their muscles properly ready without tiring them out. It is also important for female soccer players to perform because it triggers the muscles that are particularly weaker on the female athlete in comparison to a male, and works specifically on those that help to stabilize the knee and avoid injury.

Nutrition and Fatigue
Sports nutrition is a major component to how well an athlete will perform. There are several subjects that must be taken into account when evaluating nutrition such as energy, nutrient, and fluid needs of an athlete. Athletes that train in the morning do not get the proper intake that is needed in order to perform throughout practice. At Rutgers there are several sports that practice or have lift in the morning. The women’s soccer team, men’s soccer team, football team, and baseball all either have lift or practice before 9am. As an athlete here at Rutgers I have seen firsthand the routine that a majority of players have in the morning. With practice early most athletes do not set their alarm to get up and make sure that they are having a proper breakfast before training. When athletes do not have the proper breakfast before training energy intake is limited. The body must then use fat and lean tissues for energy therefore resulting in loss of strength and performance (Ray). Another factor that becomes evident when practicing the morning is the amount of fluid intake that is consumed before practice. Since most athletes do not wake up hours before practice the amount of fluids that are consumed are limited. Athletes must be “well-hydrated before exercise, and consume adequate liquid during and after performance to balance fluid loss”. These two variables of not having proper nutrient and fluid intake further result in athletes being more susceptible to fatigue. Without proper nutrition fatigue becomes a key factor in performance. Since the majority of athletes that train in the morning do not have the proper intake of nutrients and fluids fatigue sets in more easily. A study was done to determine whether fatigue affects the ability of an individual to balance on an unstable platform. The data that was collected highly supports the notion that fatigue significantly decreases the balancing ability of an athlete. Fatigue ultimately has an effect on the system of neuromuscular control around the knee. It was found that “some form of muscle spindle desensitization or perhaps ligament relaxation and Golgi tendon desensitization occurs with excessive fatigue” (Johnson). This fatigue may then lead to decreased muscle response and a poorer ability to maintain balance. Nutrition and fatigue both connect to the increase in susceptibility of suffering a knee injury. Both of these factors also connect to the timing of practice. If athletes were to train in the afternoon then they would have more time to properly prepare for training. This time would allow athletes to make sure they are receiving a proper intake of both nutrients and fluids. Proper nutrition decreases the amount of fatigue that an athlete will suffer throughout training.

The Sleep Factor of the Female Athlete
Many female sports teams at Rutgers University have a practice time that is very early in the morning. Although there is little direct literature found on the effects of training in the morning versus training in the afternoon or evening, one factor that this time does affect is the sleeping habits of our athletes. In an article entitled “Sleep of Athletes-problems and possible solutions,” in the Journal of Biological Rhythm Research, there have been many experiments proving that sleep deprivation decreases physical performance, while increasing risk of injury, and that is directly related to the time period in which an athlete competes. Especially for student-athletes, it
is difficult to handle both schoolwork and sports. Quite frequently, it is required of the athlete to wake up early for practice, then go to classes all day, return home at night and spend hours studying or doing school work only to get low number of hours of sleep and wake up and do it all again the next day, expecting to be at peak performance for practice in the morning. This type of stress on the body leads to fatigue, lack of concentration, and muscle deprivation; which makes for a breeding ground for injury. “Most basic components of performance, such as temperature, muscular strength, flexibility, metabolic and psychomotor functions, have rhythmic peaks and troughs that follow a circadian pattern. This phenomenon explains why sports performances peak in the afternoon or early evening” (Davenne). An athlete’s reaction time, and attention are significantly reduced during the night or early mornings and therefore, studies have shown that injuries are more likely to occur at these times. Additionally, when an athlete wakes up too early for training, the growth and repair that the body needs from the previous day’s training is hindered because of lack of sleep. The demands on student athletes today in terms of balancing training schedules, schoolwork, classes, work, and family and friend commitments all lead to a depletion of the body and more susceptibility to injury. With a practice time that is scheduled in the afternoon, the body is at its most alert point, has the warmest core body temperature, and allows the athlete to perform at her peak with the least risk of injury.

The Female Athlete’s Body Clock

Studies found in the European Journal of Applied Physiology have also shown that exercise performance has a higher daytime rhythm in the late afternoon than in the morning, soon after a person wakes up. This leads to maximal strength of leg and back muscles, arm muscles, anaerobic power, and peak performance of vertical and broad jumps (Reilly). A person’s core body temperature is at its best during the afternoon, this plays a major factor in decreasing the risk of injury. At this time, an athlete’s task seems less arduous and easier to physically perform because their internal body clock is matched up with the external factors surrounding the athlete such as light, temperature, etc. Often times, especially if a team is out of season coaches must work around the schedules of teams that are currently in season, and therefore get first priority to Rutgers athletic facilities, i.e. the bubble. As a result of this, players and coaches have no choice but to hold practices sometimes as early as six in the morning. This greatly affects the body clock of the female athlete. Waking up when it is still dark outside, and freezing, can trick the body into thinking it is still asleep. Without a proper warm-up, and the with the extreme intensity of the physical demands at any given practice at that time of day, an athlete could be at extreme risk for injury, especially in female soccer players when the ACL tear is so common. Furthermore, especially in a team and contact sport such as soccer, it is imperative not only to be at the top of one’s performance physically, but mentally as well. Fatigue not only affects a person’s muscles, but also one’s cognitive performance, this is perhaps the most dangerous risk that an athlete runs. One slip up or lapse of concentration can lead to a number of injuries not only to oneself but to others as well. The body clock greatly influences an athlete’s risk of injury, and having more time to sleep, and performing at times when the body is at its peak helps to decrease this risk.

For our service project we decided to write a letter to Rutgers Athletic Director, Tim Pernetti. A good amount of teams that practice or lift here at Rutgers do so in the morning. In light of the research that we conducted we found it to be essential that we stress the overall risk factors that can come from training in the morning. We found that there may be indirect correlations to time
of practice and injury. As we discussed in the Classapedia, certain factors such as nutrition and sleep patterns can be seen as factors that indirectly link to injuries suffered in morning practices. As of right now the Rutgers Football team has changed their time of training. We believe this would be a great area to focus an experiment on. The football team already has data over the last several years of injuries that have occurred due to training. Those injuries were when the football team was practicing in the afternoon. Due to switch of schedule, the football team will now be holding practice in the morning. We believe that an experiment should be done to evaluate our hypothesis that claims more injuries will occur due to the football team is practicing in the morning.

As student athletes here at Rutgers we believe that this subject needs to be invested more in order to prevent more injuries from occurring. Throughout our research we were not able to find any direct evidence that time of day affects injury. In further research we were able to find indirect correlations that we need to be looked at further. In conclusion we hope to through our research Mr.Pernetti will view this matter as a serious one and conduct an experiment in order to ensure that we are protecting student athletes from unnecessary injuries.

Attached is the letter to Rutgers Athletic Director, Tim Pernetti.

Dear Mr. Pernetti,

As soccer players here at Rutgers University, we are concerned with the not only the progression of our own program, as well as the health of our teammates, but also with all of our fellow student-athletes and the teams in which they play for. As you are well aware, the Rutgers Women’s soccer team has suffered a tremendous amount of injuries over the past few years, and has had to overcome great obstacles to earn the success that we’ve had. Therefore, when the opportunity arose for us to research and examine any topic of our choice for our class Ethics in Science class, we decided to investigate sports injuries, and what we could do to decrease our chances of getting hurt and ensuring the good health of all Rutgers athletes.

After extensive research on varying factors that could contribute to an athlete getting injured, we have come to the conclusion that although we realize it is impossible to prevent injury all together, there are ways in which the heads of our athletics programs can lower the risk of injury, especially one specific type that as soccer players here we have seen too often, the anterior crucial ligament tear. There have been many tests, experiments, and studies done that prove that certain warm-up and ACL prevention exercises can be done in order to decrease the chance of injury. Our team specifically does these exercises; however we still believe that there can be other factors that play a role in the way we manage our bodies and stay fresh and healthy to compete at our optimum performance.

One such factor that we specifically had a difficult time finding research on, but still believe could have an important part in decreasing injury is the time of day in which we practice. We are suggesting that teams in the morning may be more susceptible to injury because their bodies are not properly prepared to engage in such strenuous physical activity that our sports demand. Fatigue, body temperature, nutrition, and hydration could all be affected by having to wake up
early and practice. Although there is literature that suggests this, there is not really much concrete evidence to support this hypothesis. We are writing this letter to you proposing that we have a study done of programs here who train in the morning versus in the afternoon. We are aware that the football team has changed its practice time from the afternoon to the morning, and think this would be a great opportunity to use the team to find out if time of training does truly affect an athlete’s chances of getting hurt. This study we would gain more knowledge on how to stay healthy, and perform best as we represent Rutgers University in the classroom and on the field.

Thank You,

Jenifer Anzivino and Gina DeMaio
References

Davenne, Damien. Biological Rhythm Research; Feb2009, Vol. 40 Issue 1, p45-52, 8p,2


