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Grant Proposal
Katz & Smolyn

The effect of using an ankle brace on the incidence of ankle injuries by analyzing ankle weakness in high school athletes

Abstract:

Ankle injuries are one of the most common injuries in athletes, and consist mainly of torn or bruised ankle ligaments due to the continual impact of running. Ankle braces are often used in rehabilitation of the injury as they are believed to limit usage of an injured joint so it is not overly stressed upon return to play. Ankle injuries are of special concern to high school athletes today as they are among the weaker and less stretched body parts. In fact, upwards of 65% of athletes report experiencing ankle injuries per year, with up to 75% of those with previous ankle injuries experiencing re-injury (Hubbard, 2010). As ankle injuries only continue to grow in number, current protection and rehabilitation methods must be reexamined. The experiment would consist of an assessment, where people who reported having ankle injuries the past year would be asked to perform various proprioceptive and strength exercises. Methods of protection used while returning to play from injury would also be recorded- usage of ankle brace, tape, or no protection. A comparison of the bracing, taping and non protection groups assessment data will be performed. The hypothesis would be usage of ankle braces in rehabilitation would have the most significant effect on preventing ankle weakness or reinjury compared to not using a brace, or using tape. This is because the function of ankle braces is to limit the range of motion of previously injured ligaments, preventing overuse and further damage when returning to play.

Introduction:

Ankle injuries consist of a constant and continual foot-to-ground impact ankle ligaments undergo when they run (Elert, 1999). Ankle ligaments are relatively small in size, and are made of weak connective tissue. As such, when ligaments are overly stressed, the weak tissue can easily become twisted or strained, resulting in intense pain and decreased mobility known as an ankle sprain (Scarr, 2019). One of the most common intervention techniques for these types of injuries include ankle braces. Ankle braces are garments worn around the ankle, after an injured person has the ability to put weight on the foot. Ankle braces use immobilization techniques to keep the injured or torn ligaments in place to prevent excess ankle/foot rotation or movement. However, this also results in an adaptation of the running mechanism to decreased usage of certain ligaments whose range of motion is severely limited (Mass, 2019). The question to be

investigated is if ankle braces are truly successful in preventing ankle sprain weakness and thus reinjury when returning to play compared to other methods such as using tape or not using any particular method for protection when returning to play. The hypothesis would be that usage of ankle braces in rehabilitation would have the most significant effect preventing ankle weakness/reinjury compared to not using a brace or using tape. This is due to the fact the primary function of ankle braces is limiting range of motion of previously injured ligaments which are weaker and more susceptible to reinjury. This, in turn, will effectively prevent overuse or further damage when returning to play.

Specific Aims:

First, a preliminary survey must be created and conducted to determine the amount of people who have had an ankle injury in the past year. Age,sex, time since previous ankle injury would be recorded. This would likely be conducted over the internet (Survey Monkey) and sent out to various high school athletic trainers or coaches to determine if they had any athletes who had experienced an ankle injury the past year. The protective measure used tape, ankle brace, or no method when returning to play would also be recorded by the trainer. Those who did not use any of the above methods in returning to play would not be included in the survey. This would be completed during the first couple of months of school. Thus, a test subject group would be determined. The next step would be to develop an assessment of balance and strength. This assessment would consist of a series of proprioceptive and strength tests such as balancing on one foot, one leg squat, and single leg jumping. The ability to perform these exercises would be measured by using a stopwatch and counting repetitions. The assessment would be distributed to certain athletic trainers online, with an explanation of how exactly to perform each exercise. This would be done hopefully before winter break, so the athletes could come and do the exercises before their potential next season began. Lastly, conclusions would have to be drawn from the data, using the data from the experiment to determine whether the ankle brace was effective or not, compared to using tape or nothing. The analysis and write up would hopefully be done between the end of winter break and end of the year. This project will be feasible to complete even if school is still closed, I will just have to do the recruiting directly to the athletes (send the survey to the athletes themselves) and administer the assessment myself over ZOOM. Additionally, the project is feasible to complete at my high school alone due to the sheer amount of athletes who have experienced some sort of ankle sprain in the past year. There are over 6 girls and 5 boys on the Cross Country team alone at PHS who have experienced ankle sprains which is not including other sports.

Significance and Innovation:

Ankle injuries are a significant problem in any high school community. Approximately 55.5% of all high schoolers play a sport, and ankle injuries are one of the most common injuries in

athletes. Around 65-80% of athletes report being limited in training due to a foot or ankle injury (*Active*, 2017). This is mainly due to the impact on ankle ligaments as ankle ligaments help keep the bones in proper position and stabilize the ankle joint. Commonly, an ankle sprain is initially treated with icing, strengthening and a series of proprioceptive exercises. However, after the ankle has increased mobility and can be walked on without pain, a brace is then used to allow for a gradual return to play and function. The brace works by limiting the range of motion of the ankle ligaments, so they do not become overstretched. The effectiveness of ankle braces have long been debated, as some believe they facilitate healing by making sure previously injured ligaments are not overstretched, preventing reinjury. (Wheeler, 2018). On the other hand, some believe ankle braces are largely detrimental as they limit the movement of ligaments to such an extent that the ligaments are weakened more than they were previously. As such, when the brace is eventually removed, the chance of injury due to the weak ligaments would be higher (Mass, 2018). The results of this experiment will impact many high school athletes, as oftentimes athletes are told to use ankle braces without understanding the potentially positive or negative implications the ankle brace could have. In addition, it is widely acknowledged that the usage of an ankle brace limits pain while running, and thus one can conclude they are not very effective in preventing first time injuries where there is no initial muscle weakness. However, not many studies have been done on the effectiveness of the brace after the person has experienced recurrence of injury.

Approach and Data Analysis:

Firstly, a preliminary ankle injury survey would be implemented the first couple months upon our return to school in the summer. The first step would be to conduct the surveys in which I would likely need the help of Coach Koch (Princeton High School athletic trainer) to help contact athletes at PHS and coaches at other schools. I would also try to contact other coaches in other schools and ask them to implement the survey. If coronavirus is still in effect, or if sample size is too small, I could put out fliers with a money incentive online or physically in different towns. The survey would ask questions about whether one had had an ankle injury in the last year, age, sex, and time since previous ankle injury would be recorded.
The experiment would consist of the usage of an assessment to test the recurrence of ankle sprain. This would be conducted by athletic trainers, or if we are still in Coronavirus would be conducted by me over ZOOM. Important to note that all exercises must be performed barefoot and on a hard surface without the use of any brace, tape etc. Specifically, two proprioceptive exercises and two strength exercises would be used. The first proprioceptive exercise would be single leg balance in which the athlete must balance on one leg for the duration of one minute. The next task would be the same single leg balance test except now having the athlete keep their eyes closed. Both balance exercises data will be recorded in how many seconds the person could maintain balance using a stopwatch without holding onto anything or putting their other foot

down. In addition, strength exercises must also be used. The first would include single leg jumping for 1 minute. The second would be single leg squats for 1 minute. In both strengthening exercises assessments the number of repetitions completed in 1 minute would be recorded. One minute's time would be used to standardize the time amongst exercises and also to allow for enough reps to get the most accurate number. In addition, the subject would also be asked about what methods they used for return to play. The independent variables on the x-axis would include the type of treatment used, either a brace, tape or nothing. The y-axis would contain the average time for balance exercises and amount of repetitions for strength exercises. The data would be averaged for each individual exercise, and error bars would be drawn. Thus one could determine if using an ankle brace was significantly more effective (higher error bars) than using tape, or using none at all, for the various strength and proprioceptive exercises. I would then take the rest of the year to analyze the results and draw conclusions from the data I had collected. This would include drawing the graph, in addition to performing statistical analysis' to see if any other factors or independent variables played a role or had an effect on the outcome of the experiment. This would include an ANOVA test for comparison of time since previous injury and age and a two T-test for gender analysis. This would also include researching the results, whether the ankle brace is effective in limiting future injuries. The goal is to have the completed project and write-up finished by summer in order to submit it to the Mercer Science and Engineering fair August 1st.

Budget:

The budget for this project would include

- Survey Monkey budget ($25 per month). A subscription can be bought online here, and it will likely make an initial survey to find subjects more accessible to other schools.
- Money could also be needed to create fliers for recruitment of athletes in general or as an incentive. 98 c per custom flyer from FedEx, which can be shipped directly to my house. 98 x ~150 flyers=~$148.
- All exercises can be performed at home, with a stopwatch which most have on their phone. Thus there will be no equipment costs.

Professional Organizations/Presentations:

One professional organization I could join is the American Society of Biomechanics (ASB). This is an organization which promotes biomechanics education, research and fellowship of national and international medicine including orthopaedic sports medicine. Their conferences take place all over America. There are ASB Student Representative positions, in which students who demonstrate interest in research can apply to join as a part of a virtual student board. In addition, the organization has a symposium every year (this year August 3, but it was cancelled due to Coronavirus), in Georgia. The work must be submitted before June 12. Another, more local

potential symposium is the 2020 Mercer Science and Engineering Fair. This is held at Rider University between May 1 - Jul 31. The registration must be completed by August 1st.

Conclusion:

In conclusion, ankle injuries are a significant problem in not only the high school community, but the community at large. Due to the pressure of constant foot to ground impact in athletics, ankle ligaments are among the most injured ligaments, with over 125,000 people spraining their ankle everyday due to sports-related trauma (*Web mD,* 2018). Ankle braces for rehabilitation of these injuries are controversial in sports medicine, as some believe they can be extremely effective in preventing ankle injury, while others believe their limitation techniques are detrimental as they lead to further weakness of the ankle joint. As ankle injuries only seem to grow in number, it is important to evaluate modern rehabilitation techniques to ensure athletes can return to play injury free and as quickly as possible.

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