Effects of Single Leg Landing Error Score on Injury Prevention In Basketball

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Abstract

When you think of basketball and injuries, ACL injuries are common due to a lack of stability in the lower body and the frequency of changing directions. Currently pre-participation testing is used to identify abnormalities in structure, however it does not look at specific leg movement patterns. The "LESS single leg test" will help to assess specific movement patterns that are susceptible to basketball injuries. By gathering this information, programs can be developed to enhance joint stability to decrease basketball injuries. The method will be to measure participants' individual leg balance, also where and how participants land based on jumps. Based on scores, the higher the score, the more susceptible the participant is to an ACL injury. Five participants between the ages of eighteen and twenty three, with no previous injuries were given a PAR-Q to determine eligibility. Participants completed four jumps, two on each leg, and scores were given based on front and side views of each leg. Scores were broken into dominant and non-dominant legs. The results revealed that there is a difference in dominant leg versus non-dominant leg of a score of +1.

Introduction

The role of different limbs in supporting and powering the body has been studied in many aspects of basketball players. This study, "LESS single leg test" focuses on the study of static postural and balance control. Posture and balance control on each limb is essential to basketball players. The object of this experiment, however, is to show that the single leg version of the LESS test will assess specific movement patterns that are susceptible to injury in basketball players, and then use this information to create programs that enhance joint stability. In each trial, both legs will be (tested or measured) for strength and balance from each leg for every participant. The goal of this is to prove that there is a difference in the dominant leg versus non-dominant leg of each participant. The Single Leg LESS test obtains a single leg jump and a broad jump, as compared to the original LESS test that uses both legs and a vertical jump.[1] The experimenter predicts that the single leg version of the LESS test will assess specific movement patterns that are susceptible to injury in basketball players, and then use this information to create programs that enhance joint stability.

Methods

The test that is being used is the LESS Single Leg. The LESS Single Leg test focuses on static control and balance control in each leg. This test assesses specific movement patterns that makes athletes, particularly basketball players, susceptible to injuries. The inclusion criteria is that participants are between the ages of eighteen and twenty three. The participants also need to have no previous injuries. The exclusion criteria is those who have had significant previous injuries and those not between the ages of eighteen and twenty three. The LESS Single Leg test participants are Lewis EMS students between the ages of eighteen and twenty three. The test includes using a twelve inch box. The data collected will include video data, jump measurements, and FMS (flexible manufacturing system).

Needs Analysis

The experimenters created a needs analysis for a Basketball player in the Guard position. This included a movement analysis on primary movements in a Guards position such as: Sprinting, lateral movement, jumping, dribbling, closing out, passing, landing, shooting. The muscles involved are the: Gastrocnemius, quadriceps, hamstrings, tibialis anterior, gluteus medius, gluteus maximus, triceps, biceps, pectoralis major, pectoralis minor, traps, low back muscle, and core. The needs analysis includes a physiological analysis looking at primary and secondary energy systems. A Guard utilizes the Glycolytic system for fast breaks, running down the court, and maintaining defensive stance (6-30 sec). Phosphagen is for quick crossovers and is used in all movements (0-6 sec).[3] Possible injuries in this position include: Sprained ankle, ACL injury, concussion, Achilles heel injury, electrolyte imbalance, meniscus injury, labral tear in hip, dislocation of shoulder or hip, fractures, sprain wrist.[2] This test is testing the players deceleration abilities. The test is the Single Leg (LESS test). We will use a 12in. box and then have the athlete jump off with one leg into another broad jump. To efficiently test single leg landing/ deceleration.

Procedures

Before starting the experiment, each participant will be given an Par-Q to determine eligibility. We will make sure the students meet the inclusion criteria by being between the ages of 18-26 and have no previous injury. We will then gather the materials needed to perform the test. We will begin with measuring the height of all participants, followed by measuring the ground length. Participants will then step up on the box and balance on one leg. Participants will then jump to half of their height and then broad jump as far as possible. We will measure where he/she lands; the data will be recorded and this will be performed two times for each leg. We will then video record the jumps on each leg from the front and the side to determine any errors made while landing.

Results

The results for this test are pulled from the gathered video evidence and are rated in the following table adapted from the modified LESS test scoring table[4]

Hip Height	If the height of the opposite hip is dropped +1 to score	Front view
Foot rotation	If the clients foot is turned extremely varus or valgus at any point +1	Front view
Valgus knee angle	Small amount of valgus angle +1 extreme +2	Front view
Lateral trunk flexion	Client leaning left or right receives a +1	Front view
Initial landing	Landing heel-toe or flat footed +1	Side view
Knee flexion displacement	Client expresses small flexion +2 an average amount +1	Side view
Trunk displacement	Client goes through small flexion +2 an average amount +1	Side view
Total displacement	Large displacement +0 Average +1 Stiff +2	Side view
Overall impression	soft landing, no frontal plane motion +0 +2 stiff landing, large frontal plane motion at the knee or only large Frontal plane motion at the knee, +1 if average	All jumps

Each participant did a total of 4 jumps, 2 on each leg, then we recorded front and side view for each leg. The scores will be totaled on each leg, broken into dominant and non-dominant leg. The total score possible on each side is 14, the higher the score the more susceptible to ACL injury.

	Dominant	Non-Dominant
Client 1	7	7
Client 2	5	6
Client 3	2	4

Client 4	7	8
Client 5	7	8
Avg.	5.6	6.6

This table shows the results of the test, and are scored using the above scoring measures in the first table. The results of the test revealed that there is a difference in dominant leg versus non-dominant of a score of +1. Some of the results of this test are limited because the scoring is subjective. an objective measurement to equate these scores would be more accurate, this set of data also only features 5 participants including only male participants.

Excel Chart

This link is a link to the table that shows the participants height as well as their broad jump scores after the first jump. The table shows the target constant error set by measuring half the participants height out away from the box. The first number in the trial column shows their initial landing distance, and the second being their single leg broad jump score.

Conclusion

In conclusion, the LESS Single Leg Test was performed to examine the stability of each leg when landing. Dangerous injuries such as ligament tears, ACL being the major one, can occur in awkward movement patterns especially when landing or changing directions. The LESS test helps assess the specific movement patterns while landing. In a sport like basketball players must be prepared to change directions quickly and sustain adequate jumping ability, especially when landing on one leg exposes players to these types of injuries. That is why it is important that the player has good balance and stability in the lower body; From this test you can identity their weak areas from landing and correct/strengthen them. It is important to have the Needs Analysis, so it can be determined what is best for the athlete regarding training, and what possible injuries can occur, so it can be prevented. With this test we gathered information from the five clients, this was done to see if there was a significant difference of landing impact between the dominant leg and non-dominant leg. Following the scoring rubric, the results showed that there was a difference in dominant leg versus non- dominant leg. The non-dominant leg was +1 higher than the average and the dominant leg. It came to be that our hypothesis was right in that there is a difference between legs focusing on the postural and balance control.

Par Q Questionnaire

NAME:_____ DATE:_____
HEIGHT:_____in. WEIGHT:_____lbs. AGE:_____
PHYSICIANS NAME:_____ PHONE:_____

	Questions	Y	N
1	Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?		
2	Do you feel pain in your chest when you perform physical activity?		
3	In the past month, have you had chest pain when you were not performing any physical activity?		
4	Do you lose your balance because of dizziness or do you ever lose consciousness?		
5	Do you have a bone or joint problem that could be made worse by a change in your physical activity?		
6	Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?		
7	Do you know of any other reason why you should not engage in physical activity?		

Link to Lifestyle questionnaire below

lifestyle questionnaire

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[1] Medicine, National Academy of Sports, et al. “Modified Landing Error Scoring System and Noncontact ACL Injury.” NASM Blog, 9 Mar. 2018, blog.nasm.org/sports-performance/modified-landing-error-scoring-system-less-acl-injury/.

[2] Panhan, A. C., Juliana, L. M., Lucas Antônio Monezi, Milton, S. M., & Luciano, A. M. (2016). The evolution of the kinematic analysis to obtain the distance covered by basketball players. Manual Therapy, Posturology & Rehabilitation Journal = Revista Manual Therapy, 14http://dx.doi.org/10.17784/mtprehabjournal.2016.14.300 Retrieved from http://ezproxy.lewisu.edu/login?url=https://search.proquest.com/docview/1854891875?accountid=12073

[3] "Physiologic Profile of Basketball Athletes." Gatorade Sports Science Institute, www.gssiweb.org/en/sports-science-exchange/Article/physiologic-profile-of-basketball-athletes.

[4]Medicine, N. A., Penney, S., Comana, F., Lecovin, G., Yaremko, M., & Stull, K. (2018, March 09). Modified Landing Error Scoring System and Noncontact ACL Injury. Retrieved February 06, 2018, from http://blog.nasm.org/sports-performance/modified-landing-error-scoring-system-less-acl-injury/