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The Effect of an In-Season Knee Injury Prevention Program on Lower Extremity Injury Risk Factors on Collegiate Women's Basketball Players

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OBJECTIVE

One of the highest intensity sports that is being played every day throughout the world is basketball. Not only is the popularity of basketball increasing, so is the intensity at which the sport is being played. (Bird et al, 2016). High participation rates in basketball have led to a large number of injuries, especially considering that basketball poses one of the highest risks of injury in team sports. Basketball injury rates have been reported to be between 7 and 10 injuries per 1000 athletic exposures (Taylor et al, 2015). The Prevent Injury, Enhance Performance (PEP) program is a dynamic warm-up program that has been utilized in a variety of sports with the proposed benefits of reducing lower extremity injuries (Pollard et al, 2017). There have been a variety of risk factors that have been linked to lower extremity injuries and health professionals have been increasingly interested in screening for those risk factors. The Landing Error Scoring System (LESS) was developed as a reliable and valid screening tool to assess risk factors that have been associated with jumping and jump landings (Padua et al, 2009). The LESS test was found to be effective in separating athletes into high-risk and low-risk subgroups and had a sensitivity of 86% and specificity of 71% (Padua et al, 2015). This is of particular importance as we consider sports like basketball where the primary injury risk for ACL injuries in particular are associated with non-contact landing mechanics. Therefore, the primary objective of this study was to evaluate the effectiveness of the PEP program on a women's collegiate basketball team utilizing the LESS to evaluate overall risk for injury and effectiveness of the program.

DESIGN AND SETTING

All data were collected in a controlled gym setting. A 30-cm box was positioned and secured. A landing zone was marked at a distance of 10 feet in front of the box. Cameras were positioned to the front and side of the landing zone at a distance of 65 inches. iPads, version 2 (Apple, Inc.) were positioned using fixed tripods and the tripods and iPads were leveled prior to all data collection. A repeated measures design was used. All subjects were instructed on the drop-vertical jump as it has been described in the literature (Padua et al, 2009). Three successful jump trials were recorded for each subject after the first practice of the season. Data collection was repeated for all subjects at 6 weeks into the season.

PARTICIPANTS

Participants included Division III women's basketball players that were informed of the study. Athletes were recruited to participate in the study through a team announcement. All team members completed the PEP prior to each practice and competition, but only subjects who signed the informed consent participated in data collection. All team members elected to participate in the LESS screening. This study was approved by the University Institutional Review Board.

INTERVENTION

Athletes were asked to perform the 15-20 minute PEP dynamic warm-up before each practice and competitive activity. The PEP program was instructed by one of the researchers each time. The researcher provided the athletes with guided directions and cues for the six weeks of the program.

This dynamic warm-up program the independent variable and main intervention of the study.

MAIN OUTCOME MEASUREMENT

The LESS is an effective tool to identify at risk movement patterns in many sports (Padua et al, 2011). The LESS is a reliable and valid measure meant to screen athletes using a drop vertical jump (Padua, 2009). The LESS requires that the athletes complete the drop vertical jump task while being recorded from the front and from the side to capture frontal and sagittal plane motion. The maximum score for the LESS is 17 with a higher score indicating increased risk for lower extremity injury. Elite-level youth soccer athletes with LESS scores of 5 or more were at greater risk (1.2% risk difference) of sustaining noncontact or indirect-contact ACL injuries than their counterparts with LESS scores below 5 (Padua et al, 2015). This video assessment was utilized prior to the competitive season, as well as after the six-week period to identify any changes from the previous assessment. The scores collected from the LESS video assessment were used as the dependent variable in this study. Three researchers scored the LESS using the LESS scoring sheet. All researchers met a consensus for each item scored on the LESS and the total LESS score for each subject was used for data analysis.

RESULTS

Subjects included individuals of the women's basketball team that were able to perform the LESS and the PEP and did not suffer from a lower extremity injury. Fifteen subjects completed the LESS screening at Week 1 of the season. Athletes that sustained an injury after the first data collection were removed from further data analysis. Fourteen athletes the LESS screening at Week 6. One athlete was removed from the study due to ceasing participation with the team.

All data were analyzed using a paired T-test. The paired T-test is used to determine if two separate times for one group differ in means on the dependent variable. In this study, the subject scores on the Landing Error Scoring System (LESS) served as the dependent variable, and the 6-week PEP program was the independent variable. All data analysis was completed using IBM SPSS, version 26. Prior to the paired T-test, all data were analyzed for descriptive statistics. One subject was injured in the course of the season and did not complete the post-test. Fourteen subjects had complete LESS data and were used for data analysis. In Week 1 of the season, the mean of the LESS scores for the subjects was 5.14 ± 1.97 . The range of the scores in Week 1 was 8.33 with a minimum of 1.33 and a maximum of 9.66. In Week 6, the mean of the LESS scores for the subjects was 4.21 ± 2.02 . The range of the scores of this trial was 7.00 with a minimum of 1.00 and a maximum of 8.00.

CONCLUSION

The results of this study demonstrated a slight decrease in LESS scores over the course of the six-week PEP program. The results were not statistically significant. Although the results of this study were not found to be statistically significant, no member of the women's basketball team sustained a season-ending lower extremity injury during the course of the study. Similar studies that have researched lower extremity injury reduction programs have found there to be significant injury risk factor reduction through performing such programs (Petushek, 2019). However, the most successful programs have been found to be multi-modal and have included a focus on increasing strength, balance, flexibility, neuromuscular capabilities and jump-landing stabilization (Petushek, 2019). The PEP is simply a dynamic warm-up and as such did not include strengthening or any focus on jump-landing stabilization. However, the PEP is a low cost and low time commitment intervention that could easily be employed by sports medicine

professionals or strength and conditioning specialists working with teams and has proved to have high compliance by the athletes (DiStefano, 2016). Although the results of this study were not statistically significant, there was clinical value as there was a decrease in the mean LESS scores for the subjects in a 6 week time frame. The PEP has

been shown to be effective in reducing knee injuries in other studies. This study may have benefitted from additional participants to increase the power of the study and areas for future research could include a multi-center study.

KEY WORDS: *PEP Program, Knee Injury Prevention, Injury Risk, Injury Screening*