

An Investigation Of The SWAY Balance System As An Injury Prediction Tool In Intercollegiate Athletics

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Abstract

Context: The use of a tool/instrument to predict the risk of injury in an individual is rather new. Typically the method for assessing one's risk of injury is to look at their physical training, body composition, blood markers, age, gender, etc. Recently there has been an emphasis on the use of a physical screen such as the Functional Movement Screen or the Balance Error Scoring System. The main issue with this form of testing is they are subjective and rely on the evaluator's knowledge of the test and ability to consistently score the subjects being tested as well as being time consuming when performed in mass. Thus, we are looking to answer the question of whether or not a decrease in overall balance scores as measured with the SWAY Balance System correlate with an athlete's predisposition to injury and will an athlete's balance scores improve after a season of sports participation? **Objective:** With the rapid acceleration of technology and the requisite for an objective assessment tool in healthcare for assessing patients, there has been a push to find additional methods for assessing injury risk. The technological advancement in tablets/phones and the inclusion of an accelerometer has come to a point that it is comparable to current industry standards. In terms of this project; the intent of using the SWAY Balance System is to evaluate its use as an injury predictor tool. Prior research has validated its ability to measure postural sway in comparison to current instruments now used for assessing a patient's balance. **Design:** This experimental study uses a case control design with the SWAY Balance application as an instrument for assessing proprioceptive variance in Division III athletes in their pre-participation evaluations. **Methods:** Research was conducted in a clinical setting at a CAATE accredited ATEP with four athletic training students and a faculty mentor collecting data. The instruments used were an iPhone or iPad with the SWAY application. The target population was student-athletes that participated in an NCAA Division III winter sport (N=68). All participants were surveyed (demographic and medical history) and baseline data using the SWAY Balance was collected prior to the sport season after receiving participant consent. Participants were retested after sustaining any injuries that resulted in a missed activity session and then weekly until they returned to activity and at the conclusion of the season. **Results:** The data was analyzed using Pearson's Correlation, Independent T-Test, and Descriptive statistics with a significance level of 0.05. Sixty-eight participants (72.3%) completed the study. Upon analysis, only a weak correlation ($p=.05$) was found to be significant between Double Stance score and the occurrence of injury. **Conclusion:** The SWAY Balance application was able to show some prediction of risk of injury as well as to quantify the improvements in balance an athlete experiences by sport participation.

Introduction

- ◆ Sway Balance is an FDA-cleared mobile balance testing system that reinvents the way patients and athletes are monitored for signs of balance-related dysfunction.
- ◆ With the rapid acceleration of technology and the need in the healthcare system to have an objective method for assessing patients, there has been a push to find additional methods for assessing their injury risk. The technological advancement in tablets and phones with the inclusion of an accelerometer has come to a point that it is comparable to current industry standards. The Sway Balance System assists in identifying functional limitations and imbalances (not equal on the left and right side of the body) that may predispose an individual to injury.
- ◆ By understanding an athlete's balance patterns we will be able to identify and quantify potential predisposition for injury in sports/physical activities and recognize preventative strategies that will be most effective in reducing an athlete's risk of injury.
- ◆ Most physical screen tests such as the Functional Movement Screen or the Balance Error Scoring System are subjective and rely on the evaluator's knowledge and ability to consistently score the subjects.

Purpose and Hypothesis

The purpose of this study was to determine whether an athlete's overall balance score had a direct correlation with one's predisposition to injury and if balance scores improve after a season of sports participation. The hypothesis of the study was that there will be a positive correlation between injuries, balance, and improved balance from athletic participation.

Methods

Subjects

- ◆ 68 (29 female, 39 male) subjects participated
- ◆ Ages ranged from 18-24 years old (average age of 20.5 years)
- ◆ Participants selected from division III winter intercollegiate sports
 - ◆ 16 MBB (23.53%); 23 MHOC (33.82%); 14 WBB (20.59%); 15 WHOC (22.06%)

Participant Requirements

- ◆ Complete three pre-season tests to establish baseline
- ◆ Complete post-testing within 24 to 72 hours after sport participation
- ◆ Complete mid-season testing only if an injury was sustained that preventing participation in a practice/game

Procedures

Pre-testing was completed over 3-day period. Tests included:

- ◆ Surveyed (Demographic and Medical History)
- ◆ Completed three separate SWAY assessments

The six tests involved in the SWAY Balance test:

- ◆ Feet together, left tandem, right tandem, left single leg, right single leg, and simple reaction
- ◆ A total score was calculated across the six exercises and reported for each participant
- ◆ Researchers were each assigned ~ one Division III winter collegiate sport to follow-up post injury testing and end of the season assessment.

Figure 1. SWAY Balance Testing Procedure

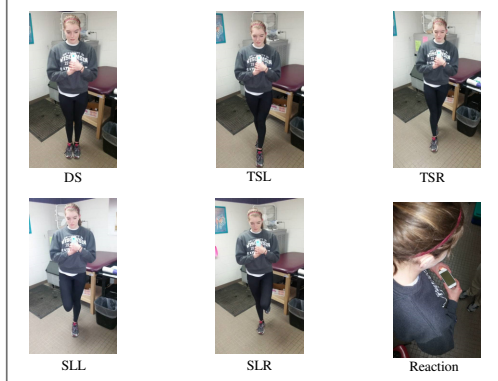
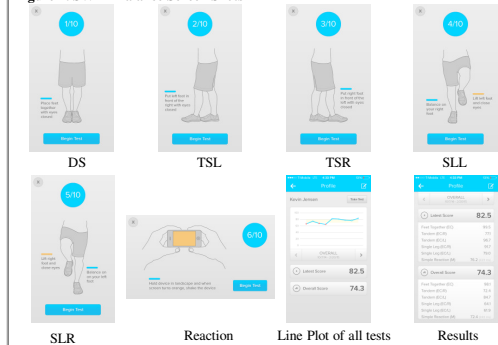


Figure 2. SWAY Balance Screen Shots



Results

Table 1. Participant change in balance scores from pre-season to post-season

Group	OS	DS	TSR	TSL	SLR	SLL	Reaction
All Participants	69.12%	69.12%	48.53%	45.59%	51.47%	58.82%	60.29%
Male	69.23%	78.57%	42.86%	28.57%	57.14%	71.43%	85.71%
Female	68.97%	60.00%	46.67%	26.67%	33.33%	40%	40%
Men's Basketball	75%	65.23%	56.41%	58.97%	56.41%	61.54%	58.97%
Men's Ice Hockey	65.22%	68.97%	44.83%	27.59%	44.83%	55.17%	62.07%
Women's Basketball	78.57%	75.00%	56.25%	56.25%	62.50%	68.75%	68.5%
Women's Ice Hockey	60%	78.57%	56.52%	60.87%	52.17%	56.52%	52.17%

OS= Overall Score DS= Double leg Stance TSR= Tandem Stance Right TSL= Tandem Stance Left
SLR= Single Leg Right SLR= Single Leg Left SLL= Single Leg Left Reaction= Simple Reaction

Summary and Conclusions

- ◆ A weak inverse correlation between Double Stance score and the occurrence of injury ($P=.05$) was found to be significant. Meaning as balance scores increased (improves) the injury rate/occurrence decreased.
 - ◆ 12 participants were injured (17.65%) during their respective sport season and missed 1+ practices/games. Due to the small sample size a larger population is needed to increase the chance of possibly injuries in order to possibly find a significance with using the SWAY Balance as an injury predictor.
- ◆ As seen in Table #1, all groups showed an improvement in overall balance scores as well as the individual components after participating in an intercollegiate varsity sport.
 - ◆ Both men's and women's basketball players showed a greater improvement in scores from pre to post-season testing. However their baseline scores were lower compared to the both hockey groups. It was also observed that both basketball groups struggled more with the tests and exhibited weaker hip strength (not tested).
 - ◆ There was a concern over the lack of pre-season conditioning thus leading to greater gains in balance that would normally be obtained.
- ◆ The ability to assess an individual's balance on a regular basis and compare it to a baseline score could assist the healthcare practitioner in assessing the patient's readiness to return to activity or their performance development.
- ◆ Additional research should focus on lower extremity hip strength both pre and post season in comparison to balance scores and injury occurrences with a larger population.

References

- ◆ Kiesel K, Plisky PJ, Voight M. Can serious injury in professional football be predicted by a pre-season Functional Movement Screen? *North American Journal of Sports Physical Therapy*. 2007; 2(3):76-81.
- ◆ Chorba, R, Chorba, D, Bouillon, L, Overmyer, C, Landis, J. Use of a Functional Movement Screening tool to determine injury risk in female collegiate athletes. *North American Journal of Sports Physical Therapy*. 2010; 5(2): 47-54.
- ◆ O'Connor FG, Deuster PA, Davis J, Pappas CG, Knapik JJ. Functional movement screening: predicting injuries in officer candidates. *Medicine and Science in Sports Exercise*. 2011;43(12):2224-30.
- ◆ Wang, HK, Chen, CH, Shiang, TY, Jan MH, Lin, KH. Risk-factor analysis of high school basketball-player ankle injuries: a prospective controlled cohort study evaluating postural sway, ankle strength, and flexibility. *Archives of Physical Medicine and Rehabilitation*. 2006;87(6):821-5.
- ◆ Patterson, JA., Amick, RZ., Thummar, TT., Rogers, ME. Validation of measures from the smartphone Sway Balance application: A pilot study. *The International Journal of Sports Physical Therapy*. 2014;9(2):135-139.
- ◆ Patterson, JA., Amick, RZ., Pandya, PD., Jorgensen, MJ. Comparison of a mobile technology application with the Balance Error Scoring system. *International Journal of Athletic Therapy & Training*. 2014;9(3):4-7.
- ◆ Davis, GA., Iverson, GL., Guskiewicz, KM., Pfitz, A., Johnston, KM. Contributions of neuroimaging, balance testing, electrophysiology and blood markers to the assessment of sport-related concussion. *British Journal of Sports Medicine*. 2009;43:136-145.

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