SWAY Balance Mobile Application as an Assessment Tool to Manage Recovery: A Case Study

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Abstract. In post-traumatic athletic rehabilitation, balance assessment is used for prognosis. We compared the SWAY balance Application to the BESS assessment during the rehabilitation of a 19 year old with an ACL tear and arthroscopic reconstructive surgery. One day prior to the procedure and twice per week throughout rehabilitation, balance was assessed. Bivariate correlation revealed a non-significant negative correlation between pre-op and post-op scores, $(r = -0.362, p > 0.05)$. This could be due to limited data of baseline measures and six rehabilitation measures. Additional data points may prove the efficacy of SWAY as an objective balance assessment in a clinical environment.

1. Introduction

Apart from being a good prognostic marker Balance is a key component in both the maintenance of functional abilities and performance of high level physical activity(Hrysomallis, 2011). As such, for athletes, with increasing number of studies showing the benefits of balance and postural training for improved performance(Pánics, Tállay, Pavlik, & Berkes, 2008) the assessment of balance is being more regularly used for prognosis, therapeutic prescriptions(Henriksson et al., 2001), as an indication of improved functional status and readiness for return to play(Lephart, Pincivero, Giraido, & Fu, 1997). With invasive or non-invasive surgery to joint surfaces and its constituents there will be short and long term changes to the joint structures that will prevent the athlete from keeping normal balance or getting back to the levels of balance existing prior to surgery. Anterior Cruciate Ligament tears with impaired proprioception and joint position sense in athletics are not as frequent as concussions where balance is affected by disrupted motor domain of neurologic functioning. However as most of the balance assessment studies are done either for geriatric or neurologic conditions but not on mechanosensory disruptions as seen in ACL tears we have chosen a Division I collegiate athlete with ruptured ACL for our study. The effect of mechanosensory disruption and its effect on balance in the knee joint has been well documented (Lattanzio & Petrella, 1998). Most of the available balance testing systems are either, cumbersome because they need a laboratory setting and considerable time to setup or are subjective.

2. Purpose

The purpose of this study was to compare the SWAY Balance Mobile Application (SWAY) balance test to the BESS assessment. However, scoring of BESS test relies on the knowledge and clinical experience of the test administrator. There is a need for a quick, easy to use, objective balance assessment tool for use in the rehabilitation community.

3. Background

The patient was a 19 year old female with a history of bilateral ACL tear and arthroscopic reconstructive surgery. The patient indicated increasing pain in her knees after practice, and after evaluation and MRI, was referred for arthroscopic debridement, chondroplasty and Cyclops lesion removal. One day prior to the arthroscopy procedure she was made to sign a consent form, properly acquainted with the whole testing procedure and was administered a balance history questionnaire. She was then tested using SWAY and BESS simultaneously. Post-Surgery after being released for full weight bearing activity, BESS and SWAY were utilized concurrently to assess the patient's balance twice per week throughout the prescribed rehabilitation process.

4. Methodology

Sway Balance^{TM}, developed by Sway Medical, LLC, is an FDA cleared iOS mobile software application that enables clinical grade balance testing to be conducted in virtually any setting for musculoskeletal, neurological and vestibular dysfunction. It is not prone to subjective error. It is being used in this test to compare its scores with BESS scores and to know its viability as a dependable clinical grade balance test. It measures thoracic trunk sway using Apple accelerometers to estimate an individual's balance via positional change algorithms. It requires the subject to close his eyes with the device held to his chest and stand in 5 positions feet together, single leg on each side and tandem stance with alternating foot forward for 10 seconds each. After each test the scores are presented on a scale of 0-100 with 100 being the most stable and 0 being the least.

The Balance Error Scoring System (BESS) is a method of assessing static postural stability(Finnoff, Peterson, Hollman, & Smith, 2009). This test has been modified without the uneven soft surfaces for standing but the stances assumed are similar to SWAY Balance App, its total time of 20 seconds has also been split into two equal 10 second halves to correspond with the 10 second test duration of the SWAY App. The SWAY App test was done twice with intervals to prevent accommodation or errors creeping from familiarization for every one BESS testing. During the ten second duration a researcher tried to count and number every moving the hands off of the iliac crests, opening the eyes, step stumble or fall, abduction or flexion of the hip beyond $30°$, lifting the forefoot or heel off of the testing surface, remaining out of the proper testing position for greater than 5 seconds. The maximum score that can be given is 10. The whole testing procedure was video graphed and was used to verify BESS scoring.

5. Results.

Pre-op baseline BESS and SWAY scores were 6 ($\pm$2.8) and 94.7($\pm$3.6) respectively. Post-op mean BESS and SWAY scores were 9.2 ($\pm$2.8) and 92.5 ($\pm$3.9) respectively. Bivariate correlation revealed a negative correlation between these scores, however this was not significant ($r = -0.362$, $p>0.05$).

6. Conclusion.

The observed correlation in this study was not significant because of limited data points that were baseline measures and 6 rehabilitation measures. Additionally, the patient may not have fully recovered, as indicated by the higher BESS and lower SWAY mean Post-op scores. Despite a non-significant result in this case, additional data points may help conclude SWAY does measure balance in a manner suitable for providing objective balance assessments in a clinical environment.

7. References.

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