FMS Study

Introduction:

A wide variety of intrinsic and extrinsic factors contributing to the predisposition of athletic injury in football have been examined in the literature [[1-4](#_ENREF_1)]. One of the most significant risk factors in prospective injury studies has been shown to be history of previous injury [[1](#_ENREF_1), [2](#_ENREF_2)]. Suffering an injury can lead to decreases in proprioceptive input [[5](#_ENREF_5)], which can adversely alter mobility and stability in the entire kinetic chain, and lead to compensatory movement patterns. These deficits, in turn, predispose the athlete to future injury [[6-8](#_ENREF_6)]. Additionally, athletes may acquire poor movement strategies from underlying imbalances that result from the repetitive and sometimes asymmetric nature of the sport they are participating in. The changes in fundamental movement and motor control patterns that can follow an athletic injury have led to the development of movement-oriented screening tools that attempt to capture these qualitative deficits and asymmetries [[9](#_ENREF_9)]. The Functional Movement Screen (FMS) is a comprehensive screening tool used to identify movement impairments, and is utilized in a variety of clinical and vocational settings [[9](#_ENREF_9)]. The FMS is currently used to screen all athletes attending the National Football League (NFL) Invitational Scouting Combine and is utilized by several NFL teams to track the movement patterns of their athletes and serve as objective return to play criteria.

The screen involves seven tests which are each scored on an ordinal scale of 0-3, for a total possible maximum composite score of 21. The seven tests of the FMS are the deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, push up, and rotatory stability. A score of 3 is given if the individual performs the instructed movement without any movement compensation or pain. A score of2 is given if the individual completes the instructed movement with some level of compensation without pain. A score of 1 is given if the individual cannot complete the instructed movement, or is unable to assume the position to perform the movement. A score of 0 is given if the individual experiences pain at any time during the movement. Several previous studies have demonstrated good to high interrater and intrarater reliability of the FMS between both expert and novice scorers, in videotaped and real time scoring analyses [[10-15](#_ENREF_10)].

The majority of the FMS tests involve scoring of the left and right sides individually. In these tests, the overall score that is recorded is the lower score of the two sides tested. Additionally, three of the aforementioned tests (shoulder mobility, push up, and rotary stability) have associated clearing exams which are graded as either positive or negative by the presence or absence of pain, respectively. A positive on a clearing exam results in a score of 0 given to the test for which that clearing exam is used for.

The FMS has been shown to predict injuries in professional football players, firefighters, and basic training soldiers [[16-18](#_ENREF_16)]. Professional football players that scored lower than a 14 on the FMS at the start of the season demonstrated an eleven-fold increase in the likelihood of serious injury (defined as membership on the injured reserve and time loss of 3 weeks) compared to those scoring greater than 14 [[16](#_ENREF_16)]. This study established a score of below 14 as the cut off point for at risk athletes. In a follow up study, the same authors demonstrated that the presence of asymmetry on the FMS, regardless of total score, was shown to increase risk for injury in professional football players (CITATION).

Performance on the FMS has been shown to be modifiable with various forms of intervention programs [[19-21](#_ENREF_19)]. In a study conducted by Kiesel et. al, professional football players scored significantly higher on their composite scores and demonstrated fewer asymmetries following a 7 week intervention program [[21](#_ENREF_21)]. Perhaps more importantly, a significantly greater number of athletes scored above the previously established cut off score of 14 following the intervention compared to their baseline test, thus in theory reducing their risk for injury [[21](#_ENREF_21)]. It is worth noting that was no control group included in the aforementioned study, making a true causal relationship impossible to establish.

The relationship between previous injury and FMS score has not been widely evaluated. Peate, et. al found that failure of FMS (operationally defined as a score less than 16) was associated with a history of injury in the previous year in firefighters [[17](#_ENREF_17)]. However, Schneiders et. al did not find significant differences between the FMS scores of recreational athletes who reported a previous injury in the past 6 months and those who did not [[22](#_ENREF_22)]. The discrepancy in findings could be due to methodological differences in sample population. No previous study has examined the relationship between injury history and FMS scores in NFL combine attendees. Yet, the FMS is used by NFL teams to evaluate prospective players.

Our objective in this study was to determine whether the results of functional movement screen were associated with a history of previous injury in the collegiate athlete.

Methods:

After obtaining and institutional review board approval, over xxx athletes that participated in NFL combine over a four year period were retrospectively analyzed. Each athlete participated in a series of test which included the complete battery of test for FMS described previously in other NFL studies (cite reference). At the combine, records of injury history and time missed due to such injury were also recorded. Each athlete was then placed into two cohorts either FMS> or = 16 or FMS < 16. FMS for each subject was measure by certified athletic therapist. Scores of the seven FMS test were base on the athletes ability to perform each test. Zero to three points were given for a total of 21. Maximum points ( 3 of 3) were given if the athlete could perform the test without limitation. Lesser points were given if the athlete could only partially complete the task. Zero points were given if the athlete could not complete the task.

At the time of evaluate, subject age ranged from xx to xx with a mean of xx and a standard deviation of xx.

Subjects were than analyzed in terms of age, injury history, time missed due to injury and need for surgical intervention. ( Need a definition of injury) , How should we sub classify injury?

We then correlated injury history and time missed to FMS scores using (linear regression ???)- need statistical methods..

Results:

Demographics

Number enrolled

Table 1- showing subject characteristics

Those individuals with lower number had X number of previous injuries and Y number of days missed and Z number of surgical interventions. These numbers were statistically distinct from the high FMS group.

Discussion:

Review results in context of NFL

Discuss previous studies

Implications of Results.i.e FMS can not only be used as a screening tool but can serve as an aggregate score of player health.

Further studies need to include whether an intervention can improved FMS scores

Limitations: Confounding, retrospective analysis, no way to control for rehab after injury to improve FMS scores.

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