

# CORRELATION OF THE FUNCTIONAL MOVEMENT SCREEN AND INJURIES IN COLLEGIATE FEMALE DIVERS: PILOT STUDY

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## Introduction

- The Functional Movement Screen (FMS) is a physical examination that has been used as a predictive tool for identifying increased risk of injury in athletes from a variety of sports.<sup>1</sup>
- During FMS examination, movement patterns are measured in a practical and dynamic way, and these measurements are designed to detect body asymmetries, evaluate mobility and stability of whole-body movements, and spot poor-quality movement patterns.<sup>1</sup>
- With research suggesting that there is a high injury rate in collegiate divers over the course of their athletic careers, finding a way to identify and prevent these future injuries is of high significance.<sup>4</sup>
- The most common collegiate diving injuries include shoulder, back, and hand/wrist injuries.<sup>4</sup>

## Objectives

- The purpose of this pilot study was to determine if composite FMS scores correlated with injury rates.
- It was hypothesized that the low composite FMS scores will have a direct correlation with decreased injury rates because the identified deficits will be treated for injury prevention.
- It was null hypothesized that there would be an inverse correlation between decreased composite FMS scores and an increase in in-season injury rates.
- This pilot study also investigated if specific individual movement test scores correlated with injury rates and if these findings could possibly be used to help prevent injuries in collegiate diving by identifying common movement patterns indicative of injury risk.

## Methods

- A correlational study using FMS scores and the recorded number of injuries sustained by collegiate divers over 6 months.
- Sample consisted of eight division 1 female collegiate divers aged 18 to 22, with no current diving-related injuries.
- The 8 divers were tested & scored using the FMS prior to the beginning of their 2020-2021 competition season. Seven FMS movements were scored on a 0 to 3 scale. Composite scores out of 21 points were recorded.
- The number of noncontact and/or overuse injuries sustained during the 6 months following the FMS were recorded.

## Results

- Each diver completed the entire FMS testing protocol including the seven different mobility tests. The sum-total of the scores of each tests yielded their composite scores. The max composite score is 21. Composite scores equal to or below 14 have shown correlation with increased injury rates.<sup>9-12</sup>
- The average FMS composite score for all eight divers was 16.63.
- Each of the seven functional movement tests were scored individually. Movements were scored on a four-point scale 0 to 3. 0 indicating pain with movement, regardless of quality, 1 indicating inability to perform movement even with compensations, 2 indicating ability to perform movement with compensations and 3 indicating movement performed as directed. The lower score between the right and left side for bilateral movements are used for the composite score.
- The average deep squat score was 2.38. The average hurdle step score on the left was 2 and the right was 2.25. The average in-line lunge score on the left 2.75 was and the right was 2.5. The average shoulder mobility score on the left was 2 and the right was 2.25. The average active straight leg raise score was 3 bilaterally. The average trunk stability push up score was 2.5. The average rotary stability on the left was 2.25 and the right was 2.5.
- Of the 8 recruited divers, 4 divers sustained 5 non-contact or overuse injuries. Diver 3 developed a back injury. Diver 4 developed a lower leg injury. Diver 7 developed wrist and low back injuries. Athlete 8 developed a shoulder injury. Divers 1, 2, 5 and 6 did not develop any non-contact or overuse injuries throughout their season.
- A Pearson's correlation was used to determine if there was a correlation between FMS composite scores and the number of injuries a diver sustained throughout the 2020-2021 season. A significant correlation was observed between low FMS composite scores and an increased number of injuries;  $p = 0.01$ .
- A Pearson's correlation was used to determine if there was a correlation between each individual movement test score and the number of injuries a diver sustained throughout the 2020-2021 season. No significant correlations were observed between increased number of injuries and the following individual tests: deep squat, hurdle step, in-line lunge, active straight leg raise, and rotary stability. A significant correlation was observed between low shoulder mobility scores and increased number of injuries;  $p = 0.028$ . A significant correlation was also observed between low trunk stability push up scores and increased number of injuries;  $p = 0.015$ .

Table 1. FMS Composite Scores

Diver	FMS Composite Score
1	18
2	20
3	15
4	18
5	18
6	17
7	10
8	17

Table 2. Analysis Summary of Findings, Pearson's Correlation

Comparing Number of Injuries To:	$p$
FMS Composite Scores	0.010
Deep Squat Scores	0.433
Hurdle Step Scores	-
In-Line Lunge Scores	0.168
Shoulder Mobility Scores	0.028
Active Straight Leg Raise Scores	-
Trunk Stability Push Up Scores	0.015
Rotary Stability Scores	0.114

## Discussion

- The results of this study identify that low FMS scores are indicative of injury risk. Analyzing each of the seven tests more in depth also established that the shoulder mobility and trunk stability push up scores may have a greater impact on increased injury risk for collegiate female divers.
- If so, analyzing these specific movements and how they are performed by divers may indicate implementation of preventative training to strengthen these movements and their associated scores in an attempt to decrease injury risks.
- Study limitations include small subject sample, female only, data obtained retrospectively and virtually, and the FMS not accounting for other injury risk factors including age, hydration, nutrition, sleep and previous injuries.

## Conclusion

- This study demonstrated that low FMS composite scores resulted in increased injury rates in a small sample of collegiate female divers.
- Further research should be performed to examine if low shoulder mobility and trunk stability push up tests scores are reliable indicators of increased injury risk and to determine if increasing FMS scores through preventative training can reduce injury risk..
- Further research with a larger sample size should be performed to re-examine the correlation between the hurdle step and active straight leg raise scores with injury rates.
- Further research should be performed with treatment prevention on identified deficits to analyze if using the FMS with preventative treatment can lower the rate of injury in female divers.

Table 3. Injuries reported during 6 months following FMS.

Diver	Number of Injuries
1	-
2	-
3	1
4	1
5	-
6	-
7	2
8	1