Functional Movement Screen and Prior Injury in National Football League Combine Athletes

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Disclosures

HS
- Arthrex- Paid Instructor

SGK
- DJO Surgical- Consultant, Royalties, Research Support, Institutional Support
- Arthrex- Consultant, Institutional Support, Research Support
- Conmed Linvatec- Consultant, Institutional Support
- Synthes- Research Support
- Wright Medical- Consultant, Research Support
- Ossur- Institutional Support
- Smith Nephew- Institutional Support
- Medtronic- Consultant

Others
- None

Background: FMS

Functional Movement Screen (FMS) is an objective screening system intended to rank and categorize fundamental movement patterns and determine side-to-side asymmetries
- Used in pre-participation physicals
- Currently used at NFL combine
- Used by some teams for objective return to play evaluation
- Multiple studies have demonstrated good inter- and intrarater reliability

Cook, NAJSPT 2006

FMS

Scored: 0-3
Total Possible Score: 21
FMS and Injury Risk

In NFL Athletes
- One NFL team for one season
- Average FMS score = 16.9
- Difference in scores between those who were injured vs. not injured (14.3 vs. 17.4)
- Players with scores below 14 were >11x more likely to be injured (placed on IR)

Kiesel, NAJSPT 2007

FMS and Injury Risk

In NFL Athletes
- 238 scores obtained before training camp
- Players with scores ≤ 14 were >1.8x more likely to be injured (any time lost from practice or games)
- Any asymmetry, regardless of total score, had 1.8 x greater risk of injury
- Combination of total FMS score ≤ 14 and ≥1 asymmetry was specific (0.87) for injury

Kiesel, J Sport Rehab 2014

FMS and Injury Risk

In Soldiers
- Prospective study of over 2476 men (ages 18-57)
- Soldiers who scored ≤ 14 were at higher risk of injury compared to those with FMS > 14
- Concluded that poor FMS performance was associated with injury risk, but with low sensitivity, specificity, and PPV
- FMS use “not recommended” due to “miscalculation of injury risk”

Bushman, AJSM 2015

Background: Prior Injury

Previous history of injury has been shown in multiple studies as the most significant risk factor for future injury


Is there a relationship between previous injury and FMS score?
Purpose

The purpose of this study was to determine whether the results of the FMS performed at the NFL Combine were associated with a history of previous injury in the elite collegiate athlete.

Our Study

Retrospective review of 1293 combine participants from 2009-2013

Recorded demographic data, position, injury history, the need for surgery, and number of games missed due to injury

By Injury Type
- Stinger
- AC sprain
- Mechanical low back pain
- Hamstring strain
- Groin strain
- MCL sprain
- Patellar Tendonitis
- Lateral Ankle Sprain
- High Ankle Sprain
- Turf Toe

By Body Part
- Neck
- Shoulder
- Forearm/Hand
- Lumbar Spine
- Hip/Pelvis
- Knee/Leg
- Ankle/Foot/Lower leg

By Surgery Type
- ACL
- Meniscus repair/ meniscectomy
- Sports Hernia
- Shoulder labral repair
- Ankle/Foot fx ORIFs

Statistics

A one-way analysis of variance was performed with Tukey post-hoc comparisons to compare FMS score and position.

Chi-square was used for all categorical and dichotomous variable comparisons.

Spearman correlation was also used to assess the relationship between FMS, number of asymmetries, number of games missed and number of injuries recorded.

The a priori alpha level was established at p ≤0.05
Results

### Overall Injuries and FMS

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FMS Score</td>
<td>13.8 ± 2.4</td>
<td>5-21</td>
</tr>
<tr>
<td>Total # of Injuries</td>
<td>3.5 ± 1.9</td>
<td>0-15</td>
</tr>
<tr>
<td>Games Missed</td>
<td>2.3 ± 3.6</td>
<td>0-24</td>
</tr>
<tr>
<td>Total # of Asymmetries</td>
<td>0.9 ± 0.9</td>
<td>0-4</td>
</tr>
</tbody>
</table>

Results

### Number of Injuries Reported Per Player

![Bar chart showing number of injuries reported per player](chart1.png)

### Number of Injuries Requiring Surgery

![Bar chart showing number of injuries requiring surgery](chart2.png)

### Number of Non-Surgical Injuries

![Bar chart showing number of non-surgical injuries](chart3.png)
FMS by Position

Offensive and Defensive Linemen were significantly more likely to score lower on the FMS (p<0.001)

<table>
<thead>
<tr>
<th>Position</th>
<th>Number</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>OL</td>
<td>210</td>
<td>12.8 ± 2.5**</td>
</tr>
<tr>
<td>DL</td>
<td>233</td>
<td>12.9 ± 2.6**</td>
</tr>
<tr>
<td>LB</td>
<td>123</td>
<td>14.4 ± 2.3</td>
</tr>
<tr>
<td>DB</td>
<td>217</td>
<td>14.2 ± 2.4</td>
</tr>
<tr>
<td>RB</td>
<td>120</td>
<td>14.1 ± 2.1</td>
</tr>
<tr>
<td>WO</td>
<td>178</td>
<td>14.1 ± 2.1</td>
</tr>
<tr>
<td>QB</td>
<td>64</td>
<td>14.6 ± 2.4</td>
</tr>
<tr>
<td>TE</td>
<td>82</td>
<td>14.4 ± 2.1</td>
</tr>
<tr>
<td>ST</td>
<td>36</td>
<td>15.2 ± 1.9</td>
</tr>
</tbody>
</table>

FMS – Total Score

<table>
<thead>
<tr>
<th>FMS Score and Injuries/Games Missed</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FMS score</td>
<td>0.806</td>
</tr>
<tr>
<td>Total FMS Score</td>
<td>0.714</td>
</tr>
<tr>
<td>FMS Score ≤ 14 vs &gt; 14</td>
<td>0.513</td>
</tr>
<tr>
<td>FMS Score ≤ 14 vs &gt; 14</td>
<td>0.074</td>
</tr>
</tbody>
</table>

No significance

FMS Asymmetry

<table>
<thead>
<tr>
<th>FMS Asymmetries and Injuries/Games Missed</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Asymmetries</td>
<td>0.362</td>
</tr>
<tr>
<td># of Asymmetries</td>
<td>0.002**</td>
</tr>
</tbody>
</table>

The # of FMS asymmetries was associated with total number of games missed
Results: Summary

FMS Total Score

- Offensive and defensive lineman were more likely to score lower on the FMS (p<.001)
- No significant difference was seen between total FMS score and # of injuries (p=.806) or # of games missed due to injury (p=.714)
- FMS score did not correlate with # of games missed (r=.006; p=.845) or total # of injuries (r =-.008; p=.778)

FMS Asymmetries

- No significant difference between FMS asymmetries and # of injuries (p=.362)
- A statistical relationship was noted between the # of asymmetries and # of games missed (p=.002)
  - Large range of games missed (0-24)
- The # of asymmetries did not correlate with games missed due to injury (r=.016; p=.574) or total # of injuries (r=.001; p=.982)

Limitations

- Retrospective study
- Players may specifically “train” for the FMS prior to the NFL combine
- Injury history is based on collegiate medial records and volunteered information by the player
- The number of games missed due to injury may be dependent on the time of year at which the injury occurred

Conclusion

- The results of this study suggest that within elite athletes at the NFL Combine, no relationship exists between prior injury history and FMS score
- Caution should be exercised when attempting to evaluate an athlete’s FMS performance perceived to be reflective of past injury.
Bibliography