Exploring Relationships between Lower Body STI and Force Plate Performance

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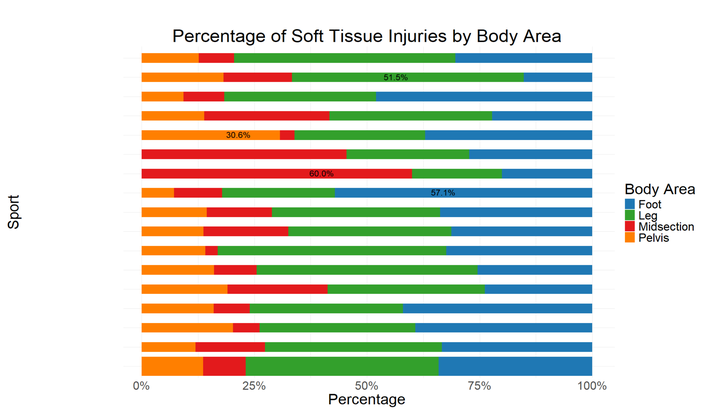
Introduction

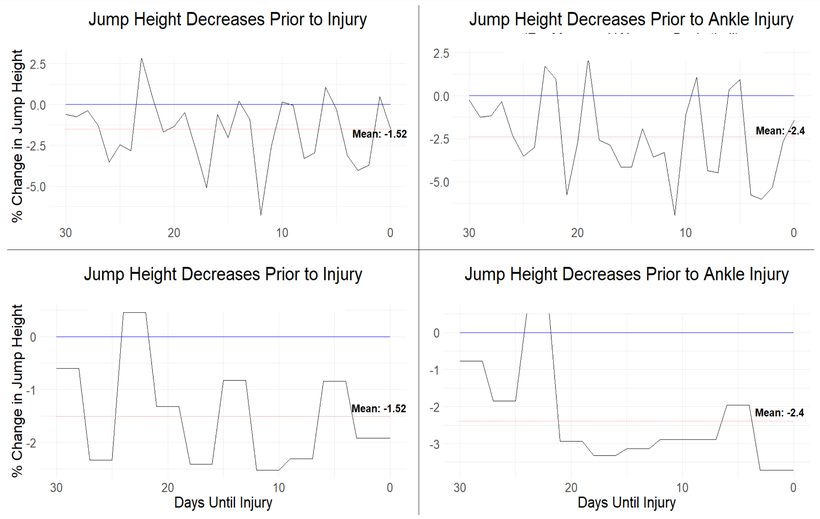


- Lower body soft tissue injuries (STI) make up approximately 60% of all injuries across sports.
- Lower body STIs are defined as injuries that involved damage to the muscles, ligaments, and tendons from the midsection down.
- Double-leg countermovement jump testing using force plates is widely available, relatively inexpensive, easy to test, and collects a variety of movement characteristics.
- Reseach Questions:
  - Which force plate counter movement jump characteristics are related to lower body STI?
  - Can injuries be anticipated using force plate data?
  - Will these insights aid in injury prevention?
- Preliminary exploratory analysis and literature review revealed little about possible connections between force plate metrics and lower body STIs.
  - One research paper found that that only 8% of countermovement jump studies observed an association with injury risk. [1]
  - Another paper found no significant associations between the force plate vertical jump scores and the likelihood of experiencing either an MSKI or a lower extremity MSKI. [2]

Methods

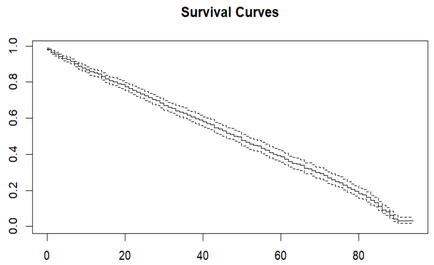
- All force plate data was collected using double-leg countermovement jumps
- Injury timeframes were specified as a 6-month period leading up to injury.
- Sports were grouped by similar demands for analysis.
  - Two Field Sports; Two Court Sports.
  - These relationships were compared using data from force plate jumps collected in the month preceding an injury event, to the average jump results from the previous five months.
- A Cox-PH model analysis was conducted on Court Sport Injuries.
  - Baseline values for athletes were the first 3 months of the injury timeframe.
  - Jump height and flight time test results from the 3 months prior to injury were compared to baseline values.

Results



- In single sport analysis, relationships between force plate characteristics and injuries were weak and inconsistent.
- When comparing within sports groups, these relationships disappeared.
  - The strongest relationship within groups is highlighted in the chart above.
- Correlation and linear relationship analysis returned near-zero results for most sports and injuries.
  - Statistically significant relationships that were further investigated by grouping similar sports once again yielded no results.
- Ankle injuries had the most significant results and the most observations.

COX-PH Survival Model

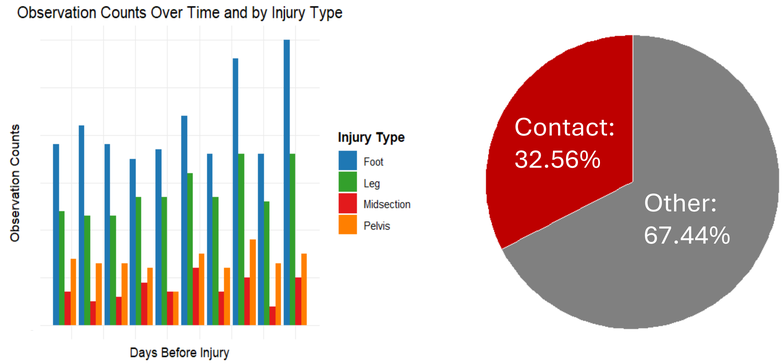


- Coefficients for jump height and flight time were not statistically significant and were trending in opposite directions.
- All other built-in model checks did not meet statistical significance thresholds.

Conclusions

- Statistical models did not substantiate relationships between force plate characteristics and lower body STIs.
- Countermovement jump characteristics are not a direct indicator of injury.
- Related literature supports the conclusion against a direct relationship between countermovement jump characteristics and lower body STIs. [1] [2]

Limitations



- The number of observations of injuries and force plate tests were low for some sports.
- Contact STIs represented approximately one-third of all observed injuries.
  - The randomness of contact injuries introduces excess variability.
- Variations in injury reporting.
- Not controlling for landings on jumps restricted the use of other potentially relevant metrics for predicting injuries. [1]

Looking Forward

- Analyzing contact injuries separately could help remove some variation and provide more concrete results.
- Incorporating other data sources from different technologies, such as wearable IMUs, could provide added insight.
  - This would allow for comparisons with variables such as training load or decelerations.
  - Previous research found players were 50-80% likely to sustain a preseason injury within a training load range of 3,000-5,000 units. [3]
- Controlling for landings in countermovement jumps or analyzing drop jumps could help determine relationships using different characteristics.
- Is it still possible to predict injuries using other methods of analysis and testing characteristics?

References

[1] Pedley, J. S. (2020) Utility of kinetic and kinematic jumping and landing variables as predictors of injury risk: A Systematic review. Journal of Science in Sport and Exercise

[2] Hando, B. R. (2022) The use of force plate vertical jump scans to identify special warfare trainees at risk for musculoskeletal injury: a large cohort study. The American Journal of Sports Medicine

[3] Gabbett, T. J. (2010) The development and application of an injury prediction model for noncontact, Soft-Tissue injuries in elite collision sport athletes. The Journal of Strength and Conditioning Research