The Biomechanics of Running on Artificial Turf

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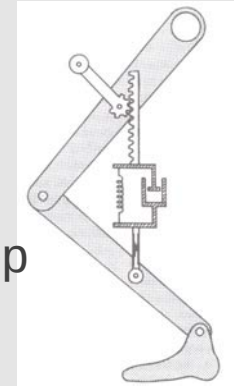
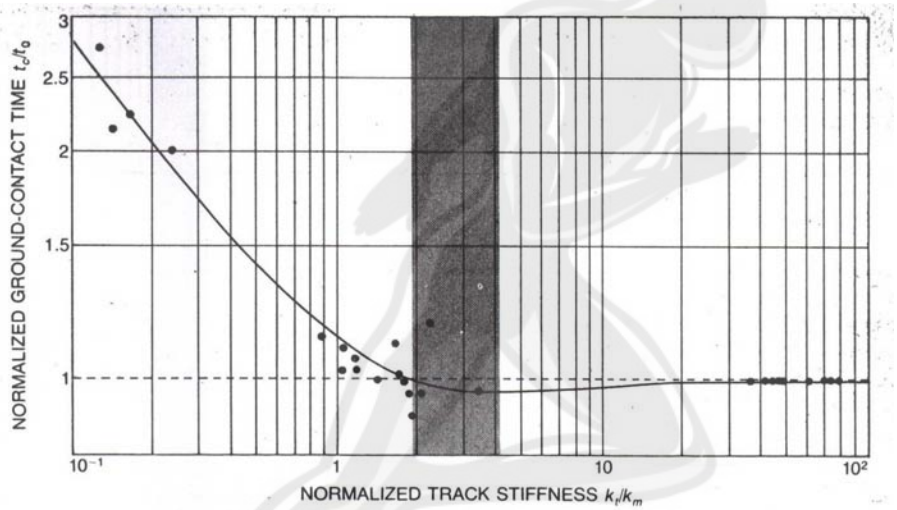
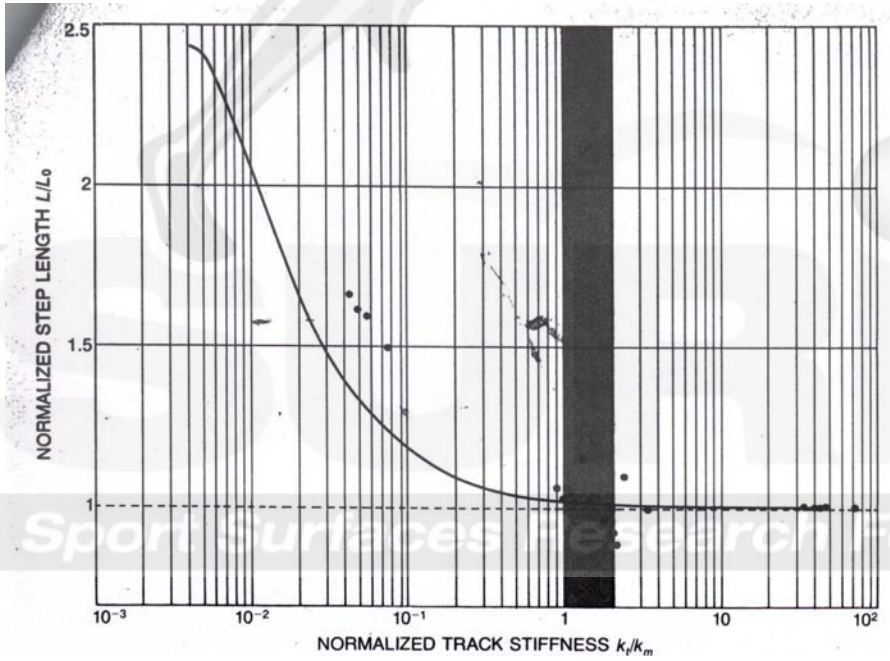
OPTIMAL TRACK COMPLIANCE

McMahon & Greene (1978)

- Model human/surface interaction
- Optimize athletic track for speed
- Speed ~ contact time & step length







New Harvard Athletic Track

- 2-3 % faster
- 50% less injuries

Injury & Comfort

- Soccer injuries 33% of all injuries in NL *(Vriend et al. 2005)*
- Small differences in injury rates between artifical and natural turf *(Ekstrand et al. 2006)*
- Low player satisfaction
- Material vs. Human testing
  - different loading patterns
  - poor correlations (Nigg & Yeadon, 1987)

AIM

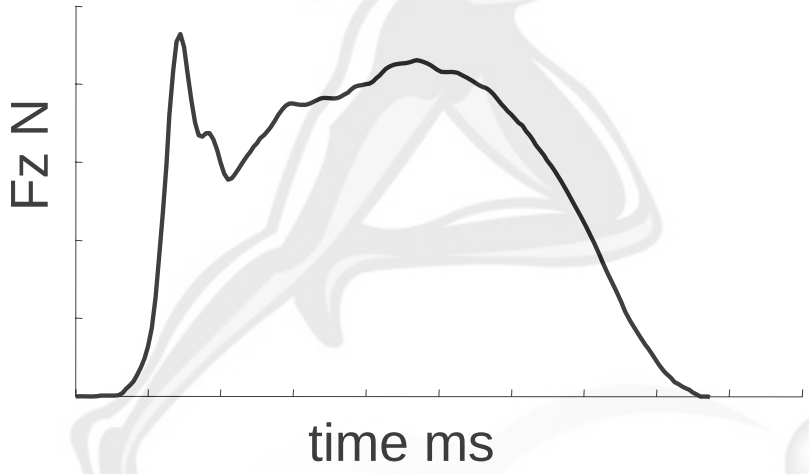
Evaluate the loading pattern that players experience on artificial soccer pitches

Experiments

- 20 soccer players (18-35 yr)
- 3 running conditions:
  - Preferred jogging
  - 17.5 km/h
  - Full sprint
- Kinetics & kinematics

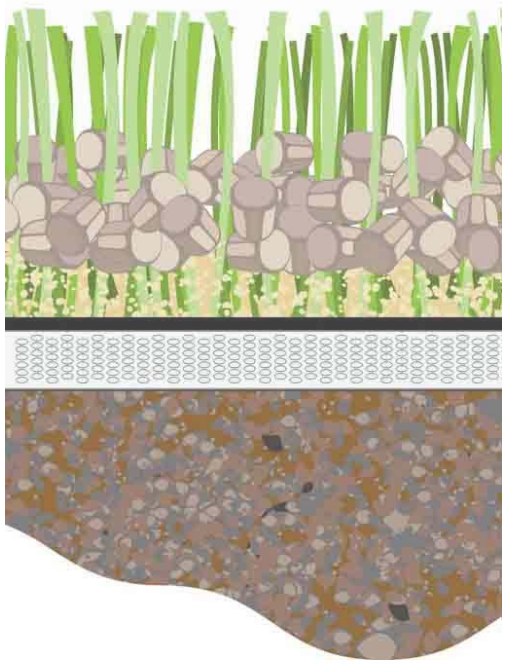
Data Analysis

- Peak vertical and horizontal ground reaction forces



- Statistics
  - Repeated measures ANOVA (P<0.05)

Experiment 1



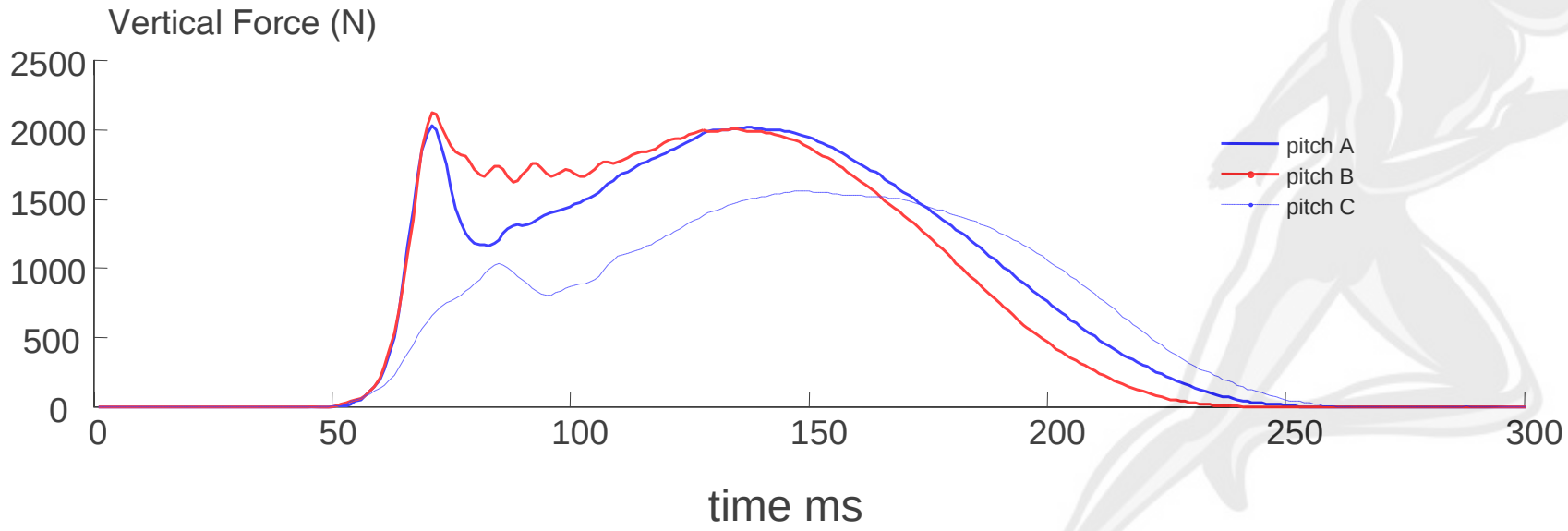
Pitch A; infill 20 mm TPE granules (2.0-2.2 mm)

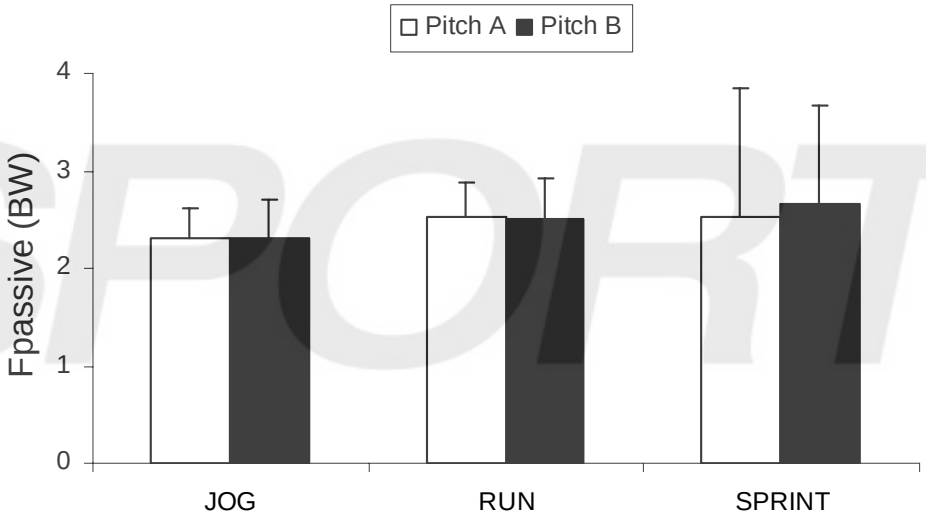
Pitch B; infill 20 mm SBR (0.8-2.5 mm)

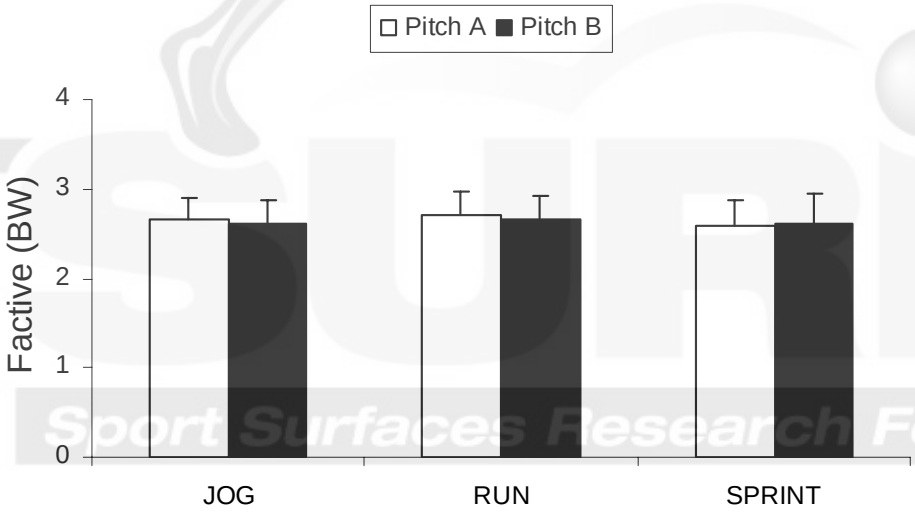
Pitch C; Pitch A + 10 mm rubber shock pad

Pitch	*Force Reduction (%)*	*Deformation (mm)*	*Energy Restitution (%)*	*Static Stiffness (kN/m)*
A	51.9	4.2	45.8	452
B	47.9	4.9	48.0	510
C	63.9	7.0	43.0	

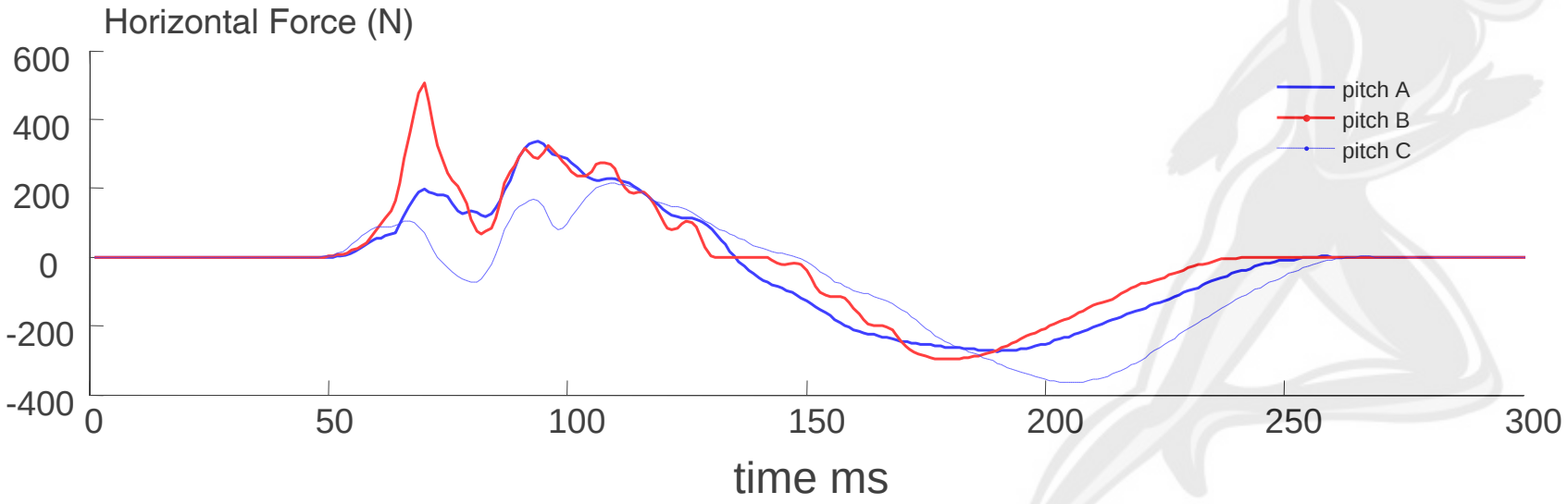
Vertical Forces



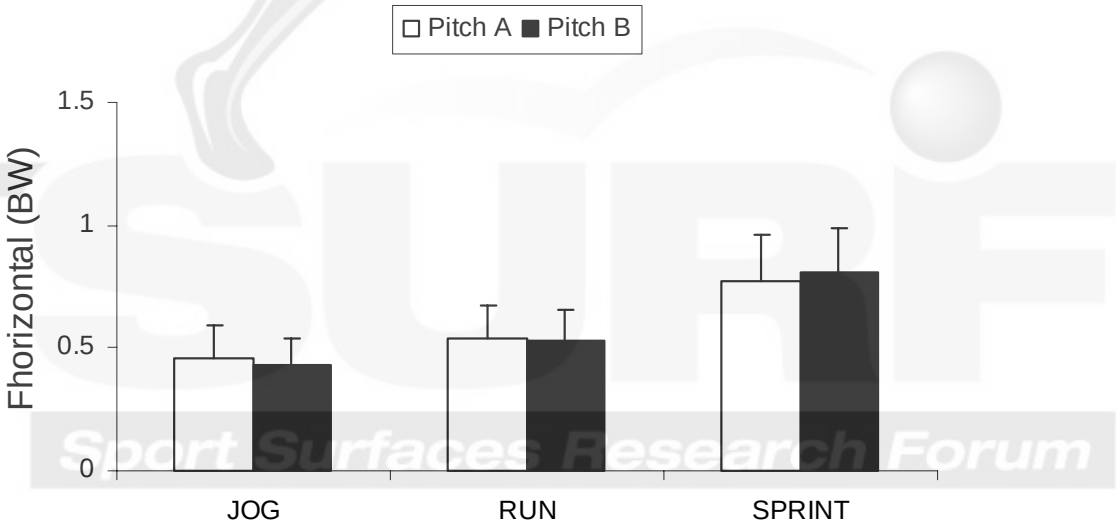




Horizontal Forces



1. No effect surface
2. Significant effect of speed



Discussion

- Surface properties significantly influence ground reaction forces of human runners.
- Surface optimization to minimize muscle skeletal loading within the FIFA requirements.
- Combined studies on biomechanics and injury epidemiology.

Acknowledgements

Rene El Kati
Jeroen Dethmers

Hans Savelberg
Paul Willems
Bart Wijers