Biomechanical analysis of traction at the shoe-surface interface on third generation artificial turf

David McGhie, Gertjan Ettema

*Norwegian University of Science and Technology (NTNU), Dep. of Human Movement Science, 7491 Trondheim, Norway

Abstract

Knowledge of the relationship between artificial turf, traction, and shoe-surface interactions is based almost exclusively on mechanical experiments. Although rotational traction traditionally has received the most attention, movements inherent to soccer are predominantly translational. The aim of this study was to investigate whether different artificial turf systems exhibit unequal translational traction properties at the shoe-surface interface with various cleat configurations in vivo. Twenty-two male soccer players (mean ± SD age 23.1 ± 2.8 years, height 1.81 ± 0.1 m, body mass 77.5 ± 6.0 kg) performed five short sprints with a 90° cut over a turf covered force plate for each combination of turf system (DU42 and DU60 top-level, DU50 recreational) and shoe (MT turf cleats, CM circular grass cleats, AP bladed grass cleats).

There was no significant effect of turf system ($F_{2, 706.48} = 0.44, p = 0.646$) or shoe ($F_{2, 706.46} = 2.61, p = 0.074$) on traction coefficient. However, a significant effect of both turf system ($F_{2, 176} = 4.63, p = 0.011$) and shoe ($F_{2, 176} = 12.63, p < 0.001$) on peak traction force was found, showing it to be lower on DU60 than DU42 ($p = 0.007$) and DU50 ($p = 0.027$), and lower with AP than MT ($p < 0.001$) and CM ($p = 0.003$). Traction force was lower on long turf with more infill and with bladed cleats. Contrary to expectations, traction coefficients remained almost identical across turf systems and shoes, indicating that players adjusted for undesirable traction conditions.

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