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Isokinetic strength qualities that differentiate rapid deceleration performance in academy male youth soccer players

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Introduction

Decelerating (DEC) is just as frequent as accelerating in contemporary soccer match play (Russell et al., 2014). Recent evidence suggests that lower body eccentric strength directly improves the ability of a player to produce and tolerate braking forces (Spiteri et al., 2014). The aim of the present study was to identify if measures of isokinetic strength can differentiate performance of a rapid DEC maneuver.

Method

Nineteen (n=19) academy youth soccer players (age: 16.7 ± 1 yrs; height: 175 ± 8.4 cm ; body mass: 69.1 ± 7.5 kg; body fat: $9.5 \pm 3.9\%$) participated in the study. Tests included: isokinetic dynamometer (Cybex II, Cybex International Inc., New York, USA) strength profiling of quadriceps (Q) and hamstring (H) peak concentric (con) and eccentric (ecc) torque (both dominant [kicking leg] and non-dominant legs) assessed at slow ($60^\circ/\text{s}$) and fast ($180^\circ/\text{s}$) angular velocities. Functional H:Q ratios representative of knee flexion ($H_{\text{con}}:Q_{\text{ecc}}$) and extension ($H_{\text{ecc}}:Q_{\text{con}}$) was also calculated; 30m linear sprint time (with 5m, 10m and 20m splits) was recorded using a single beam timing system (Witty, Microgate, Italy) and rapid DEC quantified using time to stop (TTS) and distance to stop (DTS) determined following a 20m maximal acceleration (within 5% threshold of best 20m linear sprint time) using video analysis (Dartfish ProSuite 2011, Fribourg, Switzerland) captured from a 50Hz video camera (Panasonic HDC-HS900, Japan).

Results

10, 20 and 30m sprint times had significantly large correlations with fast con peak Q torque (dom, $r=-0.624$, -0.568 , -0.621 and non-dom, $r=-0.513$, -0.512 , -0.509) with fast peak H torque comprising significant correlations in the dom leg ($r=-0.773$, -0.561 , -0.761) with moderate to large correlations in the non-dom leg ($r=-0.5$, -0.468 , -0.464). At slow velocity con peak H torque had moderate to large correlations with 10, 20 and 30m sprint times. No significant correlations were found for peak con strength in either Q or H for DEC performance (TTS and DTS). Slow velocity Ecc peak Q torque (dom, $r=-0.503$, nondom, $r=-0.542$) and time to peak torque ($r=-0.465$) was significantly correlated to DEC TTS. No significant correlations were found for fast ecc strength parameters in Q or H for either sprint or DEC performance. Sprint and DEC performance had no significant correlations.

Discussion

The present study illustrates the need for specific strength qualities for attainment of high running velocities and rapid DEC performance. Specifically, players with superior sprint speed can produce high peak con forces in both Q and H at fast velocities. DEC seems to be a unique movement skill requiring specific ecc strength qualities. Interestingly, in this study slow velocity ecc strength of the Q seems to be critical for production of braking forces and reducing the time spent DEC. Increased time spent DEC has been found to increase tissue damage and muscle soreness, subsequently affecting post match recovery kinetics (Young et al., 2012). In conclusion this study highlights the need for careful consideration to developing strength qualities needed for DEC alongside those more commonly known for sprinting and accelerating.

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