EFFECTS OF BALANCING HAMSTRING AND QUADRICEPS MUSCLE TORQUE ON RUNNING TECHNIQUE.

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INTRODUCTION: It has been suggested that balancing the isokinetic strength of quadriceps (Q) and hamstring (H) muscles can reduce hamstring injuries during running (Croisier et al 2008). The efficacy of this type of intervention has been previously explored. To further the knowledge of the H: Q relationship we have examined the intervention's affect on running technique as presented here.

METHODS: An elite male 400m runner (age: 20 yrs, mass: 78.1 kg) performed a maximal isokinetic muscle test (Kin Com Cahttanga, TN) to determine peak concentric and eccentric hamstring and quadriceps torques (H_{ecc},H_{conc},Q_{ecc},Q_{conc}) at a specific range of angular velocities (Croisier et al 2008). The athlete also ran at 9.6m/s for a full kinematic and kinetic analysis of overground running technique (8 force platforms, 22 cameras and 16 EMG channels). The tests were repeated after 10 weeks of periodised eccentric strength training.

RESULTS: The second isokinetic testing results showed a reduction of bilateral asymmetries to below 15%. H_{ecc}/Q_{conc} ratios increased for left leg (0.51 to 0.72) and right leg (0.54 to 0.70). H_{ecc}/Q_{conc} improvements are a result of increases in H_{ecc} peak torques of 19% (right leg) and 40% (left leg) at 30°/s. Significant changes in running technique were noted (see Table 1).

Table 1 Running technique variables pre and post intervention focused on correcting hamstring and quadriceps imbalances. Trials /session = 6. Steps/trial = 4.

Run technique variable	Pre Test (mean)	SD	Post Test (mean)	SD	T-Test (P value)	Effect
Step length (m)	2.20	0.04	2.25	0.04	0.02	1.21
Step frequency (steps/s)	4.4	0.1	4.0	0.7	0.09	0.80
Horizontal foot speed prior to contact (m/s)	2.3	0.2	1.8	0.2	0.00	2.93
Net vertical impulse (N.s)	90.45	4.33	96.21	2.99	0.02	1.55

DISCUSSION: The increased effectiveness of running technique was associated with foot activity prior to and during initial foot contact where hamstring EMG activity was at its highest. Changes to running technique are likely to be the result of factors related to improved hamstring strength. As post intervention values for H_{ecc}/Q_{conc} ratios were below the critical value (0.87) (Croisier et al 2008), further improvements in running technique variables could be expected with future strength gains. The athlete has since incurred a hamstring strain providing an opportunity to investigate the outcomes of his recovery in relation to running technique and leg strength.

CONCLUSION: Improving hamstring function to reduce the likelihood of hamstring injury has been shown, in this case, to improve effectiveness of foot contact during running, however the level of improvement was not sufficient to prevent a hamstring injury.

REFERENCES:

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