THE EFFECT OF HABITUAL ATHLETICS TRAINING ON MUSCLE AND TENDON ADAPTATION IN YOUNG AND OLDER ELITE ATHLETES

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INTRODUCTION

Muscles and tendons adapt in response to mechanical loading (Arampatzis *et al.*, 2007). However, different time courses of muscle and tendon adaptation in response to training (Mersmann *et al.*, 2016) may cause discordance within the muscle-tendon unit (MTU), increasing injury risk. We analysed the triceps surae (TS) muscle strength and Achilles tendon (AT) stiffness in young adult elite athletes over one season, in order to detect potential training-induced discordance between muscle and tendon adaptation. Following this, we examined the effect of habitual athletics training on young and older athletes' TS MTU mechanical properties, using a cross-sectional design.

METHODS

Triceps surae muscle strength and AT stiffness of both legs were assessed during maximal isometric voluntary ankle plantarflexion contractions using dynamometry and ultrasonography in 11 healthy younger adult elite sprinters and jumpers (23±3y), 12 master sprinters (66±7y), 12 recreationally active young controls (26±3y), as well as one young adult elite athlete, 10 months after unilateral Achilles tendon reconstruction. In our longitudinal investigation, all young adult elite athletes (11 healthy, one AT reconstruction patient) underwent regular (every 2–4 weeks) MTU measurements over one season at their respective Olympic training centres using a custom-made mobile dynamometer (TEMULAB®, Protendon, Aachen, Germany).

RESULTS

Healthy young elite athletes showed higher ($p<.05$) ankle joint moments (4.0±0.5Nm/kg) and AT stiffness (687.2±115.1N/mm) than both other groups and there were no differences in the parameters between master athletes and the young recreationally active controls (2.7±0.6Nm/kg and 574.2±93.2N/mm vs. 3.2±0.3Nm/kg and 557±70.2N/mm). Concerning our cross-sectional investigation over 1 year of athletics training, similar patterns of relative changes in TS muscle strength and AT stiffness were seen for both legs in the young elite athletes (coefficient of variation: 8.7±2.3% vs. 12.7±4.8%) over all analysed data points (on average, 16 per athlete). There were no observable increases in TS muscle strength or AT stiffness in the post tendon reconstruction athlete's affected leg over one season, which showed remarkably lower strength, but similar stiffness, compared to the non-affected leg (average value over all analysed data points: 1.8±0.2Nm/kg and 503.7±90.7N/mm vs. 3.4±0.2Nm/kg and 496.8±33.1N/mm).

DISCUSSION

Our longitudinal investigation illustrates concordant muscle and tendon adaptation in response to athletics training within our analysed sample of healthy young elite athletes. The lower muscle strength and similar AT stiffness in the affected, compared to the non-affected leg after AT reconstruction remained unchanged over one season, despite intense athletics training, indicating that AT rupture and reconstruction may lead to irreversible discordance within TS MTU. Finally, habitual athletics training over the lifespan may effectively counteract the age-related deterioration of MTU mechanical properties.

CONCLUSION

The results suggest that habitual athletics training may not necessarily lead to discordant muscle and tendon adaptation within healthy young athletes and may help prevent the degeneration of the MTU mechanical properties seen with ageing. However, athletics training appears not to be capable of effectively counteracting the observable discordance within the MTU following AT reconstruction, indicating altered muscle-tendon interaction during functional motor tasks.

REFERENCES

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