Acute effects of sustained forearm flexion tasks to failure using different anchor schemes on torque, neuromuscular, and potentiated twitch responses

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INTRODUCTION

Performance fatigability (PF) is defined as a decline in mechanical output and is influenced by factors related to muscle activation and contractile function.

Maximal voluntary isometric contractions (MVICs) serve as objective measures of PF and represent a global measure from central and peripheral mechanisms.

Previous studies that have used MVICs in conjunction with analyses of the amplitude (AMP) and spectral properties (MPF) of the electromyographic (EMG) signal to assess the effects of different anchor schemes (perceived intensity vs. relative intensity) on PF have reported mixed findings.

Therefore, the present study examined the effects of different anchor schemes on time to task failure (TTF), PF, neuromuscular responses, and potentiated twitch torque (PTT).

METHODS

On separate days, 15 men (Mean ± SD: age = 21.5 ± 2.3 yrs; height = 183.6 ± 6.7 cm; body mass = 87.2 ± 12.5 kg) performed forearm flexion MVICs before and after sustained, isometric tasks anchored to a rating of perceived exertion of 6 (RPEFT) and the torque at RPE = 6 (TRQFT).

Electromyographic AMP and MPF were recorded from the biceps brachii (BB). Supramaximal stimuli were delivered to the motor nerve of the BB following the MVICs to quantify PTT.

Repeated measures ANOVAs assessed the mean differences between anchor schemes for torque, neuromuscular responses, and PTT.

Paired t-tests compared the magnitude of change (((pretest – posttest)/pretest) × 100) for the dependent variables.

RESULTS

The TTF for the RPEFT was longer (588.2 ± 90.9 s vs. 60.8 ± 21.3 s, $p < 0.001$) than the TRQFT, but MVIC decreased similarly (12.7 ± 9.5 % vs. 20.3 ± 7.9 %, $p = 0.054$).

Electromyographic AMP did not change (p = 0.288), while EMG MPF decreased (15.7 ± 10.2 % vs. -1.4 ± 19.3%, $p = 0.011$) for the TRQFT only.

Mean decreases in PTT were comparable for both tasks (p <0.001-0.003), although the percent change was greater for the TRQFT (49.6 ± 16.1 % vs. 17.9 ± 18.5 %, $p < 0.001$).

CONCLUSIONS

The difference in TTF and the similar reductions in MVIC suggested that subjects reached a sensory tolerance limit.

Electromyographic AMP remained unchanged, indicating that muscle activation was maintained throughout both tasks.

Furthermore, analysis EMG MPF and PTT, the TRQFT induced greater peripheral perturbations to contractile function compared to the RPEFT.

RESULTS

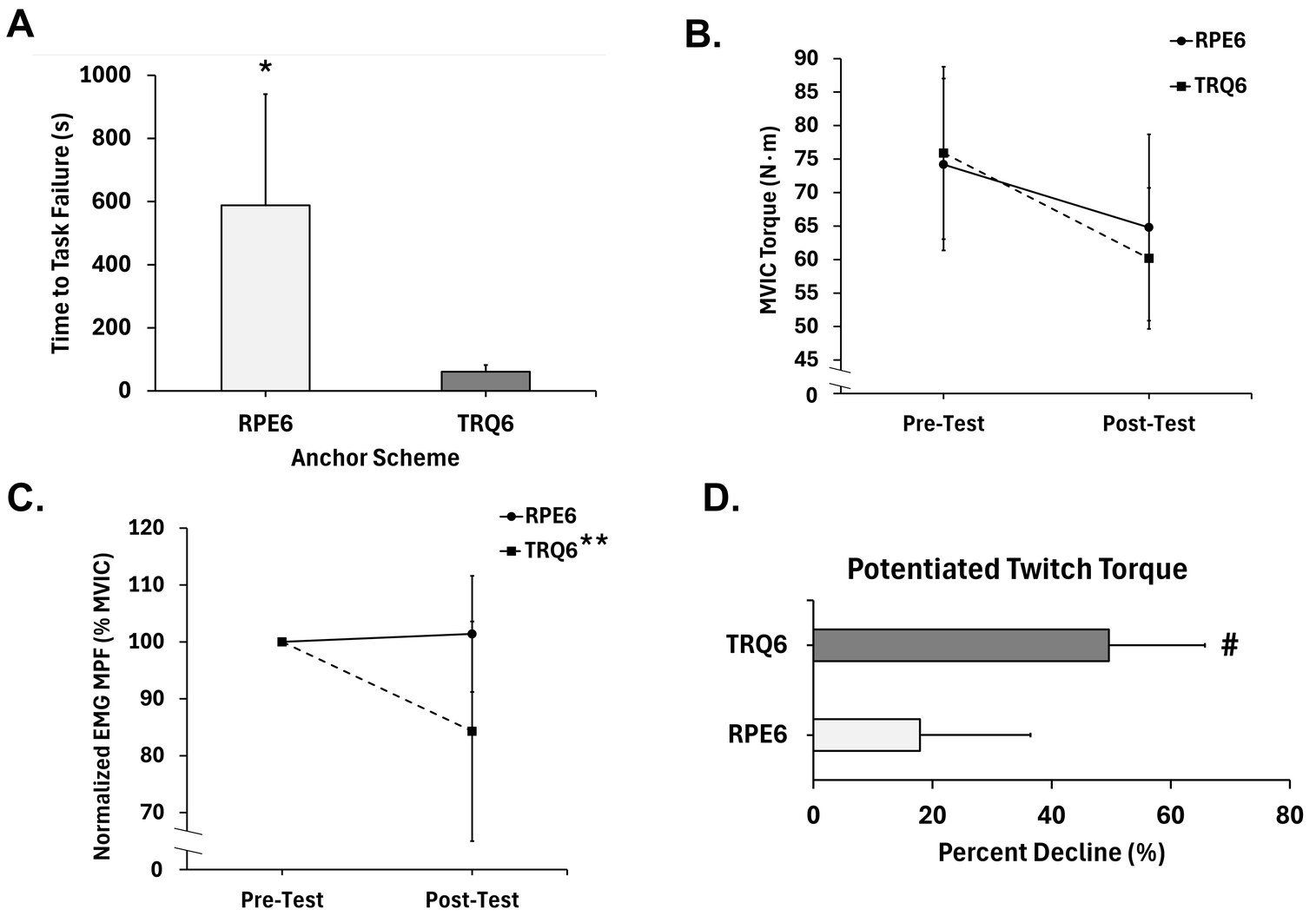

Figure 1. A. Mean (± SD) time to task failure for the ratings of perceived exertion fatigue task at RPE = 6 (RPE6) and the torque fatigue task at the torque produced during the first 1-s of the RPEFT at RPE = 6 (TRQ6), respectively (* RPE6 > TRQ6, $p < 0.001$); B. Pre-Test vs. Post-Test torque values from the maximal voluntary isometric contraction (MVIC) assessments for RPE6 and TRQ6, respectively; C. Pre-Test vs. Post-Test normalized electromyographic mean power frequency (EMG MPF) values form the MVIC assessments for RPE6 and TRQ6, respectively (** TRQ6 > RPE6, $p = 0.011$); D. Percent decline for the potentiated twitch torque (# TRQ6 > RPE6, $p < 0.001$).

PRACTICAL APPLICATIONS

Coaches and practitioners can utilize tasks that are autoregulated based on a perceptual intensity or relative intensity and anticipate similar effects on PF. However, if the goal is to enhance metabolic adaptations, employing a relative intensity rather than a perceived intensity may be advantageous when designing programs for unilateral forearm flexion muscle actions.