IMPACT MECHANICS DURING STOP AND GO TASKS UNDER FATIGUED AND NON FATIGUED CONDITIONS

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INTRODUCTION

Fatigue affects muscle activation and coordination during complex tasks such as walking, jumping, and landing [1,2,3]. Moreover, it is commonly believed, and there is some evidence to support, that injuries occur more often near the end of practices and competitions when athletes are fatigued [1]. However, few studies have examined the effects of fatigue on landing mechanics during stop and go tasks [e.g. 4,5]. The fatiguing protocols used in these exemplar studies targeted the musculature used specifically for jumping, which may not be representative of the cardiovascular and muscular fatigue that develops during a game or practice. The purpose of this study was to examine landing mechanics in male and female athletes performing stop and go landing tasks in fatigued states representative of game conditions.

METHODS

Twenty healthy athletes (10 male, 10 female) participated in this study after giving their written informed consent. The testing session involved warm-up, pre-fatigue testing, a fatiguing protocol, and post-fatigue testing. The pre and post fatigue testing involved 4 different tasks: 1) 90 degree cut, 2) 45 degree cut, 3) forward step, and maximum vertical jump after landing from a 0.5 m high box.

The fatigue protocol consisted of a 10 minute progressive incline treadmill run followed by an “M-drill”. The M-drill was a 3 by 3.5 m pattern of forward, backward, and side ways steps with vertical jumps. The pattern was repeated until 1) lap time slowed to 150% of their fastest time or 2) completion of 10 laps and inability to achieve maximum jump height.

During pre and post testing, GRFs were measured with two AMTI force plates. High speed digital video data were collected using two Photron cameras. The subjects performed 3 vertical jumps between each post trial to maintain their level of fatigue. The GRF data for the 90 degree cut and vertical jump tasks only are presented in this abstract. Data were analyzed with a three way repeated measures ANOVA at $\alpha = 0.05$.

RESULTS AND DISCUSSION

The initial vertical impact GRF peak of the cutting leg was significantly greater in the post fatigue trials as compared to the pre fatigued trails (Figure 1). Additionally the time to the first vertical GRF peak was significantly longer in the post fatigue trials (Figure 1). A non significant decrease in impulse was also observed pre to post fatigue (p=0.056; Table 1). There was no significant gender or task interaction.

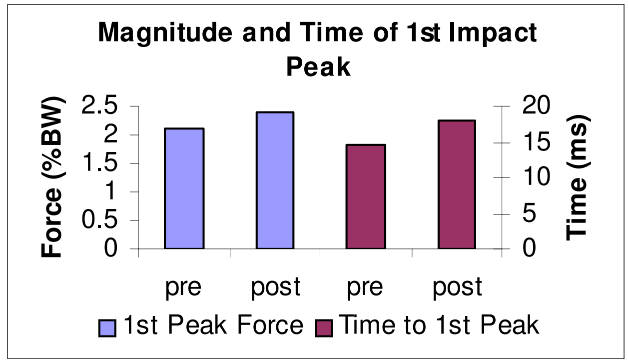

Figure 1: Impact peak & time to peak pre and post fatigue.

The increased peak impact forces and times to peak impacts suggest altered landing strategies utilized by the subjects in the fatigued state. This is supportive of previous research using localized fatiguing protocols which suggests subjects respond to fatigue with varying combinations of increased bilateral variability and increased impact forces during the landing phase of stop and go tasks [4].

CONCLUSIONS

Significant increases were found in vertical GRFs during the landing phase of stop and go tasks in pre and post fatigued conditions, along with significant difference in the timing of the GRF peaks. Alterations in landing mechanics observed in fatigued states, such as those that might be encountered in practice and game situations, may pre-dispose athletes to increased risks of injury. Further research in the relationship to fatigue and injury occurrence appears to be warranted.

REFERENCES

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Table 1: Vertical GRF variables pre and post fatigue across stop & go task. All values are mean ±SD. *p<0.05.

	First Impact Peak* (% BW)	Time to Impact Peak* (ms)	Contact Time (ms)	Impulse (Ns/BW)	Peak Force (%BW)
Pre	2.06 ± 1.8	14.5 ± 3.8	401 ± 86	0.63 ± 0.30	3.67 ± 1.8
Post	2.27 ± 1.9	17.0 ± 7.3	396 ± 71	0.61 ± 0.29	3.81 ± 1.9