THE INFLUENCE OF ELASTIC ATHLETIC APPAREL ON HIP JOINT MECHANICS AND GROUND REACTION IMPULSES DURING A SPRINT START

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INTRODUCTION

The use of elastic athletic apparel has recently gained popularity in a variety of different sports. One such garment, the adidas TechFit Powerweb compression shorts, are comprised of nylon-elastane compression shorts with highly elastic thermoplastic polyurethane bands crossing the posterior aspect of the hip joint (Figure 1). It is theoretically plausible that engineered apparel such as this could provide athletes with enhanced performance. However, although these types of garments have received some research attention [1,2], clear descriptions of the mechanisms by which performance benefits could be facilitated have yet to be published.

Figure 1: adidas TechFit Powerweb compression shorts.

Therefore, the purpose of this investigation was to quantify the influence of elastic athletic apparel on the athlete during a particular athletic movement. Specifically, the effects of adidas TechFit Powerweb compression shorts on hip joint angle, hip joint moment, and ground reaction impulses during a sprint start were studied.

METHODS

Data were collected on 15 male power athletes (sprinters, bobsledders, & football running backs). The subjects performed 5 maximal effort sprint starts in a laboratory setting while wearing adidas TechFit Powerweb compression shorts, as well as 5 trials in loose fitting running shorts as a control condition. The ground reaction forces of the third step of the sprint start were measured with a Kistler force plate collecting at 2400Hz. Concurrently, the motions of 3 small reflective markers attached to the foot, shank, thigh, and lower back were captured using 8 Motion Analysis high-speed digital cameras operating at 240Hz.

Kintrak software was used to calculate hip joint angle at touchdown and takeoff, average hip extension moment over the duration of stance phase, as well as the total, vertical, and forward propulsive impulses applied to the ground.

RESULTS AND DISCUSSION

In the elastic apparel condition, the hip joint flexion angle at touchdown was decreased by 15° and the extension angle at takeoff was increased by 10°, causing a total decrease in range of motion of 5° (Table 1). Despite these altered kinematics, the average moment generated by the hip joint did not change. The total impulse applied to the ground also did not change between conditions. There was a trend towards a 3% decrease in vertical impulse and an increase of 2% in forward propulsive impulse, however, these differences were not quite significant at the α=0.05 level (p=0.07 & 0.06, respectively).

These data indicate that elastic apparel can greatly alter hip joint kinematics without detrimentally affecting the moment generated by the hip. These changes to the hip joint mechanics did not change the total impulse applied by the sprinter to the ground, but did seem to cause a redirection of the push-off force to a more posterior orientation. As the goal of sprinting is to accelerate the mass of the body in the forward direction, this could therefore facilitate a performance benefit.

REFERENCES

1. Doan BK, et al. *J Sports Sci.* **21(8)**: 601-610, 2003.
2. Kraemer WJ, et al., *J Str Cond Res.* **10(3)**: 180-183, 1996.

Table 1: Average values and standard deviations of all variables of interest of all subjects for the two conditions.

	Elastic Apparel Condition	Control Condition	p-value
Hip Joint Flexion Angle at Touchdown [°]	49 ± 9	64 ± 6	0.00
Hip Joint Extension Angle at Takeoff [°]	17 ± 8	7 ± 6	0.00
Hip Joint Range of Motion [°]	67 ± 6	71 ± 7	0.02
Average Hip Joint Extension Moment [Nm]	192 ± 30	191 ± 27	0.41
Total Impulse [Ns]	230 ± 24	231 ± 28	0.64
Vertical Impulse [Ns]	222 ± 21	227 ± 27	0.07
Forward Propulsive Impulse [Ns]	55 ± 8	53 ± 8	0.06